Periodical
TECHNOLOGY DEPT
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# CONSTRUCTION Methods

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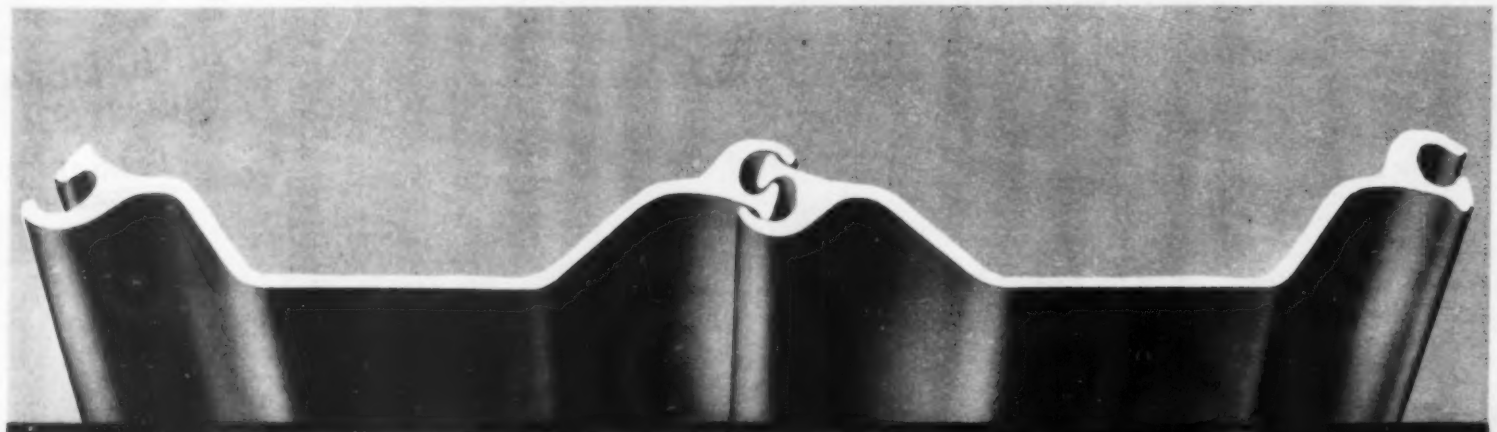
December, 1934

Price 20 Cents

**TOWER FOR TRIBOROUGH BRIDGE on Ward's Island New York City, one of largest P. W. A. projects, being built by Triborough Bridge Authority with loan and grant of $44,200,000 from Public Works Administration.**

Photo, Potter



# BETHLEHEM AP 8

## *The* heavy-duty piling section *for construction work*

THIS cofferdam for Pier No. 4 of the Fore River Bridge between Quincy and Weymouth, Mass., is 88 ft. long by 42 ft. wide. It was built of Bethlehem Steel Sheet Piling Section AP8, 15 in. wide, weighing 31 lbs. per sq. ft., in lengths of 48 and 55 ft.

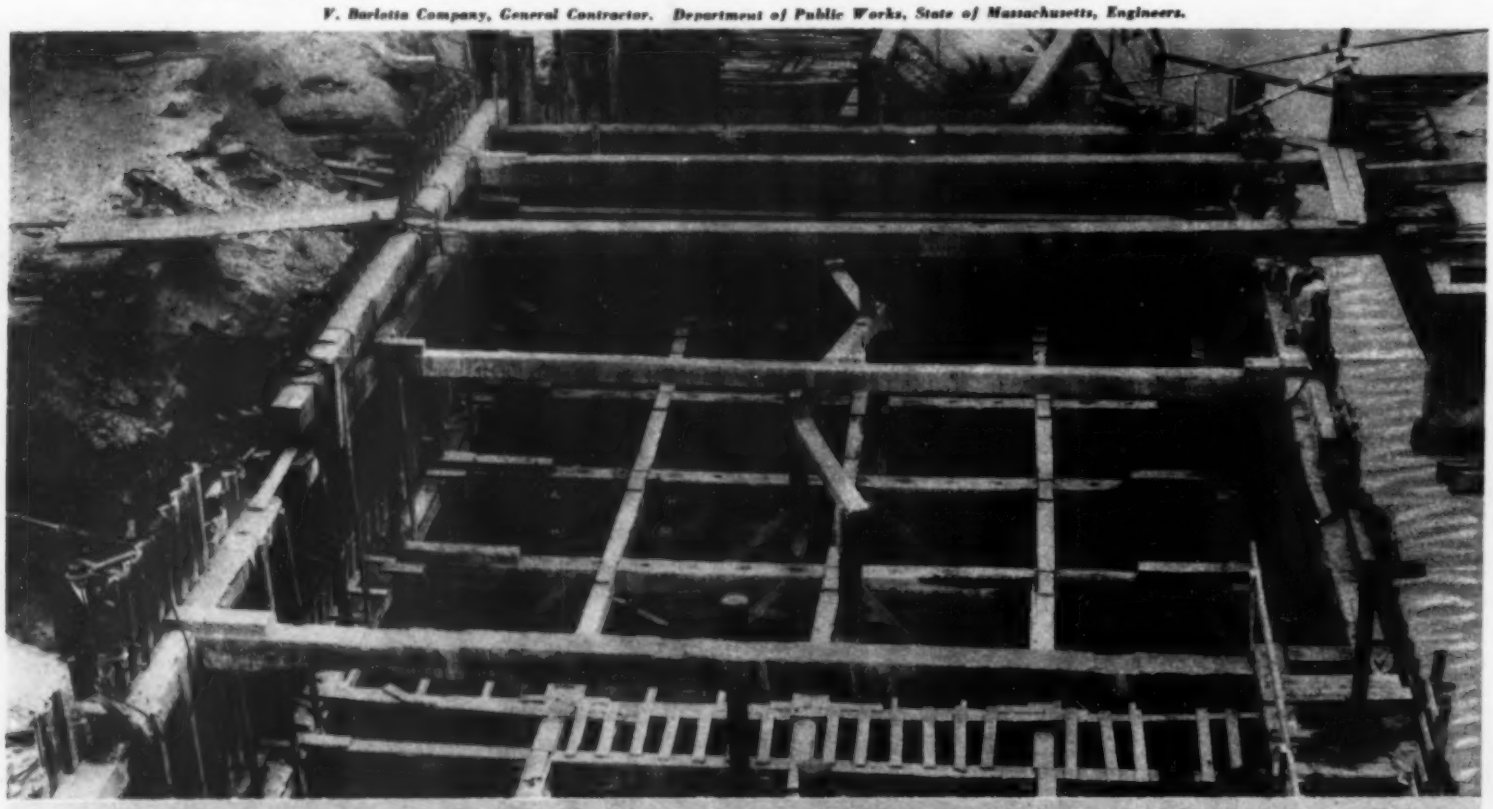
Before unwatering, excavation was made to 38 ft. below high-tide level. A concrete footing 11 ft. thick was placed under water with a bottom-dump bucket. The cofferdam was then unwatered down to the top of footing, 27 ft. below high tide. The leakage through the piling was negligible. The steel sheet piling along the river face will be driven down as a permanent protection to the pier.

Bethlehem Section AP8 is designed particularly for cofferdam construction such as this. It is a rugged section, capable of withstanding exceptionally rough usage in driving and pulling. It has heavy, strong interlocks, which afford ample surface for contact with the driving hammer.

With Bethlehem Section AP8 the individual piling lengths are not staggered, but are driven with all webs in the same vertical plane. Wherever a concrete seal is poured directly against the steel piling—as was done here—it is obvious that arranging the piling in this way instead of staggering it results in a substantial saving in concrete. In addition, this arrangement makes assembly easy and provides bearing of each pile on the bracing.

If you are planning any project involving the retaining of earth or water in either permanent or temporary work, the chances are that Bethlehem Steel Sheet Piling will offer a satisfactory, economical way of meeting the problems involved. There is a Bethlehem Piling Section for every condition.

*V. Barletta Company, General Contractor. Department of Public Works, State of Massachusetts, Engineers.*



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TECHNOLOGY DEPT.

# Construction Methods

McGraw-Hill Publishing Company, Inc.,
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ROBERT K. TOMLIN, Editor

DECEMBER, 1934

WILLARD CHEVALIER, Vice-President

*Editorial Staff*: Vincent B. Smith, N. A. Bowers (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald


## Enforce the Code or Suspend It

● Among contractors throughout the country there has been developing an undercurrent of feeling that the construction codes, as now administered, are giving them, not a New Deal, but a raw deal. Lack of machinery to effect prompt discipline of code violators has put the man who is sincerely trying to comply with code regulations at a distinct disadvantage in competing for work. This smoldering discontent burst forth into full flame last month at a meeting of contractors under the auspices of the New York Administrative Agency of the Divisional Code authority for General Contractors, culminating in the passage of a resolution which said in effect, "Enforce the Code or suspend it."

Dissatisfaction with operating conditions under the Construction Code centered upon the alleged breakdown of NRA's machinery to insure general compliance, thus opening up the field to construction "bootleggers", at the expense of the responsible members of the industry. The resolution follows:

"Whereas, the ultimate foundation of successful application of our code is dependent upon universal compliance with its provisions, and

"Whereas, the National Recovery Administration has ruled that the prosecution of code violations cannot remain in the hands of our industry, but must be lodged with the NRA itself and through it with the Department of Justice, be it, therefore

"Resolved, that the assemblage of general contractors notify the General Contractors' Code Authority in Washington that unless the National Recovery Board shall at once give us unequivocal guarantees of its power and intention to prosecute all properly certified code violations we shall forthwith ask for the indefinite suspension of the General Contractors Division of the Construction Industry Code, Chapter II, and the suspension of the provisions of Chapter I in so far as they apply to general contractors as defined in Chapter II."

Hutton, in the Rochester (N. Y.) Democrat and Chronicle

***Get the Leader Over and the Rest Will Follow!***

## Diversion of Motor Vehicle Tax Revenue

● In the broadest survey yet attempted tax payments by owners of the various classes of motor vehicles in the United States in 1932 have been determined by the U. S. Bureau of Public Roads. The survey shows that the owners of 24,619,602 motor vehicles paid an approximate total of $1,001,150,000, of which $838,830,978 was from state fees and taxes and the remainder from federal, county, municipal and personal property taxes, and bridge and ferry tolls.

Of particular interest to highway engineers and contractors is the statement in the report that the sum of $74,902,028, approximately 9 per cent of the revenues derived from state motor-vehicle and gasoline taxes in 1932, was diverted to uses not related to roads and streets. The principal items of diversion included payments to general funds, $39,652,339; unemployment relief $19,546,456; schools $14,522,113; and other purposes, $1,186,120.

In spite of opposition from the highway and related industries this diversion of motor vehicle taxes is increasing rather than diminishing, for supplementary figures in the report show that in the following year, 1933, diversion was stepped up to a total of $91,166,913, equivalent to 11.1 per cent of the total receipts of $822,097,515 from state motor-vehicle fees and gasoline taxes.

The situation disclosed by these alarming figures should stimulate particular interest in the forthcoming annual convention of the American Road Builders' Association (Washington, D. C., Jan. 22-25) at which one of the main themes for discussion and action will be highway revenues for highway purposes only.

## *Road Builder's Number*

**The January issue of *Construction Methods*, appearing on the eve of the annual convention of the American Road Builders' Association in Washington, D. C., Jan. 22-25, will be the annual Road Builders' Number.**

## To Expand Construction Program

● Extension and expansion of the program of public works construction and housing are in the forefront of administration planning for the coming year, according to Washington advices. In so far as possible direct relief is to be discarded in the country-wide effort to create work. The program aims at another big drive to energize business to the point where it will move under its own momentum.

Private credit will be given an opportunity to help in carrying forward this federal program, or to put private dollars to work to curtail the Government's outlay. By its very magnitude as a new business stimulating force, the plan now forming indicates the administration's recognition that the Government cannot continue indefinitely to borrow money that does not earn a return.

The new contruction program is designed to absorb the coming winter's relief load and carry on public works before the present PWA program slacks off materially next year. Housing, both urban and rural, that to date has been largely experimental, will probably rank higher than public works in the new program. Railroad construction will be projected into extensive grade separation and elimination work to be financed in a manner that will relieve the carriers of a much larger proportion of the cost.

Both federal and non-federal construction of public works will continue, with a larger proportion of federal construction set up on a reimbursable basis than in the past. All government departments and agencies now are submitting a schedule of projects that run into big figures. A heavy backlog of non-federal projects is waiting for allotment.

Combining all types, the programming now under way is designed to lift construction to a substantial percentage of normal volume.

## Unemployment Insurance

● Prospects all favor the passage of an unemployment insurance law at the next session of Congress, with a large public works program regarded as a necessary complement of such a statute. Insurance, according to current proposals, would take care of the policy holder for twenty weeks, but at the end of that time, at least, there would have to be a job for him or he would be added to the relief rolls. This would, of course, defeat that part of the plan which contemplates no additions to those ranks. State and municipal public works are being relied upon to supply an increasing number of jobs and it is believed that a sizable federal program will be continued. Despite the activity of the federal government the total volume of public works is still less than one-half that of 1928.

# *Switchboards* of Industry

A FEW weeks ago newspaper readers the country over were shocked to learn of the tragic death of three unknown children on a Pennsylvania mountain-side. Then followed the discovery of a man and a woman shot to death in an obscure railroad station somewhat farther west.

For a time both affairs were mysteries. Then through traces picked up at several points, it seemed reasonably certain that the five had been together. But for a time the police were halted at that point. The identity of the unfortunate party could not be established.

Every effort was made to follow up such clues as were available in the form of personal peculiarities and belongings. But to do that it was necessary to enlist the services of certain trade and occupational groups who might be in position to narrow the field of search. So the business press was called into service.

An editor of the *Boot and Shoe Recorder,* business journal of the boot and shoe trade, was invited to examine the shoes worn by the children, to photograph them and to publish the pictures with appropriate trade descriptions in his columns. Thus shoe dealers the country over would have an opportunity to identify the source and possibly the purchasers of those particular shoes.

At the same time it was noted that the dead woman had peculiarly formed feet. It was thought by some that this feature might be characteristic of a toe dancer, so the police requested that all theatrical publications publish a description of the woman in the hope that some of their readers might be able to identify her.

Thus expert knowledge and special facilities for effecting quick and nation-wide contact with selected occupational groups were put at the disposal of the authorities.

In this case it happened that before these agencies were brought into action the identity of the victims was established by other means. But it is not the first time that the business press has been drafted for such service, and in many other cases it has been the key that has enabled the authorities to solve similar problems of identity.

This tragic episode is one of those rare occasions when the general public is made vividly and dramatically aware of the vital function that is constantly performed by the business press. The man in the street knows that in number of readers or diversity of reading content few business journals can compare with the newspapers and magazines of general circulation. But he is not so likely to appreciate that, within its own field, every reputable business journal must render expert service to a distinct group of readers, self-selected on the basis of their industry, trade or professional interests.

When, as in this case, expert knowledge is required to observe, report and interpret the facts and a swift, thorough coverage of a special trade or occupation is required, the business journal is the instinctive choice of those responsible for getting results. It is the recognized central switchboard of its field.

That is why those who would put their data and experience at the service of a special group publish it through the reading pages of such journals, and why those who would keep abreast of progress in their fields follow those pages closely. And that is why the manufacturers of the materials, equipment and services that are used in any particular trade or industry instinctively use the advertising pages of its business paper when they wish to broadcast to its buyers the merits of their products or the standing of their houses.

As one such journal, *Construction Methods* seeks to effect an exchange of information, data, experience and judgment that may be of interest or value to those engaged in the construction industry. And in so doing, it becomes a direct and efficient channel through which all may reach that particular audience which includes the engineers, constructors, manufacturers, dealers and others who compose what we know as the construction field.

Willard Chevalier

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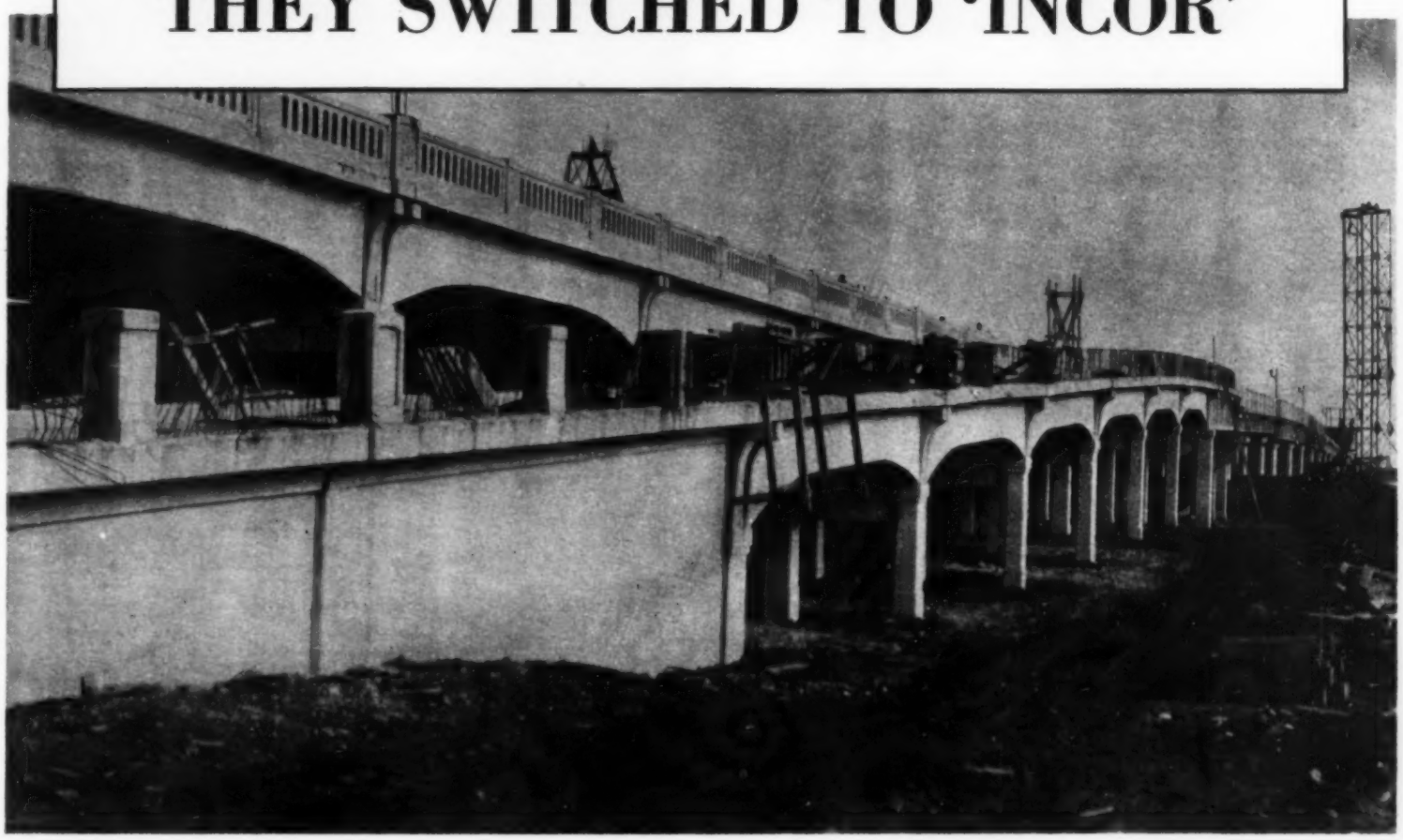
OWNERS are enthusiastic over their Diesel economies in power costs—enthusiastic, too, about other "Caterpillar" features. Luebkeman Brothers write: "The 'Caterpillar' Diesel burns all the fuel, runs evenly when it idles, accelerates fast, lugs better than anything we have ever seen." Ask for the full story of "Caterpillar" Diesel Tractors and Power Units. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

A. J. Schrader, of Scranton, Pa., uses "Caterpillar" Diesel power to remove the overburden for coal stripping operations.

## AMERICA GOES DIESEL · AMERICA GOES DIESEL

For Griffith Co., on the All-American canal in California, a Diesel-powered shovel loads material into a giant "buggy" pulled by a "Caterpillar" Diesel Seventy-Five.

# TO SPEED UP WINTER WORK THEY SWITCHED TO 'INCOR'



## *Result,—Heating Costs Reduced; Frost Hazard Greatly Lessened; Opened 2 Months Sooner*

To simplify Winter construction problems, many contractors have switched to 'Incor' on work in progress. Here is a case in point:

On State Highway 29, near Newark, N. J., an important super-highway viaduct, 1800 ft. long, consists of 30 concrete-beam spans and 9 steel-girder spans. As cold weather came on, 'Incor' Cement was used on the last four steel-girder spans.

### *Forms Stripped 11 Days Sooner*

With 'Incor', forms were stripped in 3 days instead of 14—saving 11 days on each of four spans. Without building additional forms, contractor completed job two months sooner.

Tarpaulins over the deck slab retained concrete's heat; wood-burning salamanders under the span, and tarpaulins hung on windward side to shut off draught, protected concrete during the important 48-hour curing period following placement. By using 'Incor', the contractor also obtained more workable concrete with a lower water content, facilitating placement by towers and chutes.

### *Write for New 'Winter' Book*

A new book on "Winter Construction" is now ready; it contains practical information on all types of Winter concreting. Address 'Incor' 24-Hour Cement, Room 2200, 342 Madison Ave., New York, for free copy. 'Incor'* is made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other leading cement manufacturers.

* Reg. U. S. Pat. Off.

# 'INCOR' 24-Hour Cement

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*This is only one of the pages in the new Hazard Book of Facts,-*

NO. 7

# HOW DOES LAY-SET CUT TIME COSTS IN REPLACEMENT?

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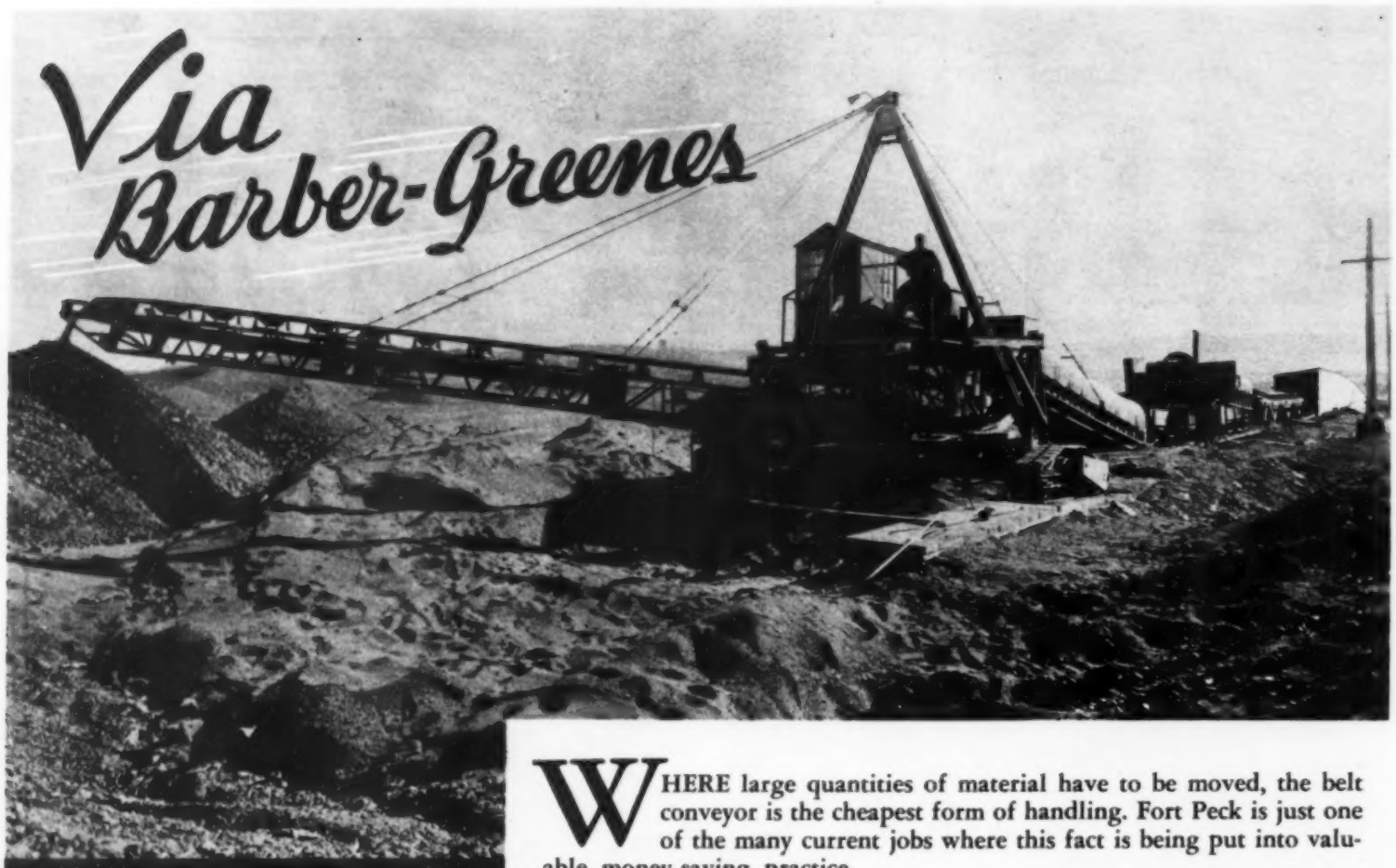


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WHERE large quantities of material have to be moved, the belt conveyor is the cheapest form of handling. Fort Peck is just one of the many current jobs where this fact is being put into valuable, money saving, practice.

2,950 feet of Barber-Greene belt conveyors are handling the excavated earth and shale on the Fort Peck Dam job. All of the conveyors are working in one long tandem series, storing the material. The last unit, the Barber-Greene stacker has a 100 foot tail section which can telescope for 50 feet, and a 50 foot boom, which can be swiveled or fanned 180°. The stacker moves forward a few feet on its own power-propelled crawlers after each complete swing of the boom. After the telescoping section is extended all the way, a 50 foot section is added to one of the conveyors—the operation requiring less than 30 minutes.

*All of the Barber-Greene belt conveyors on the Fort Peck job are 36" wide, and have Barber-Greene Roller Bearing Idlers. There are 4 field conveyors approximately 250' long; 2 field conveyors 925' long, each; and the stacker which is 150' long. The power-propelled crawler mounted stacker gives valuable flexibility, and makes it possible to store at a steeper angle, as the stacker is able to climb the incline under its own power.*

These B-G Conveyors are handling 800 tons of material per hour, working 20 hours per day. Before the job is completed, they will have handled well over two million yards.

If you have any material to handle, send in the coupon for complete information on Barber-Greene portable and permanent belt conveyors. There is no obligation.

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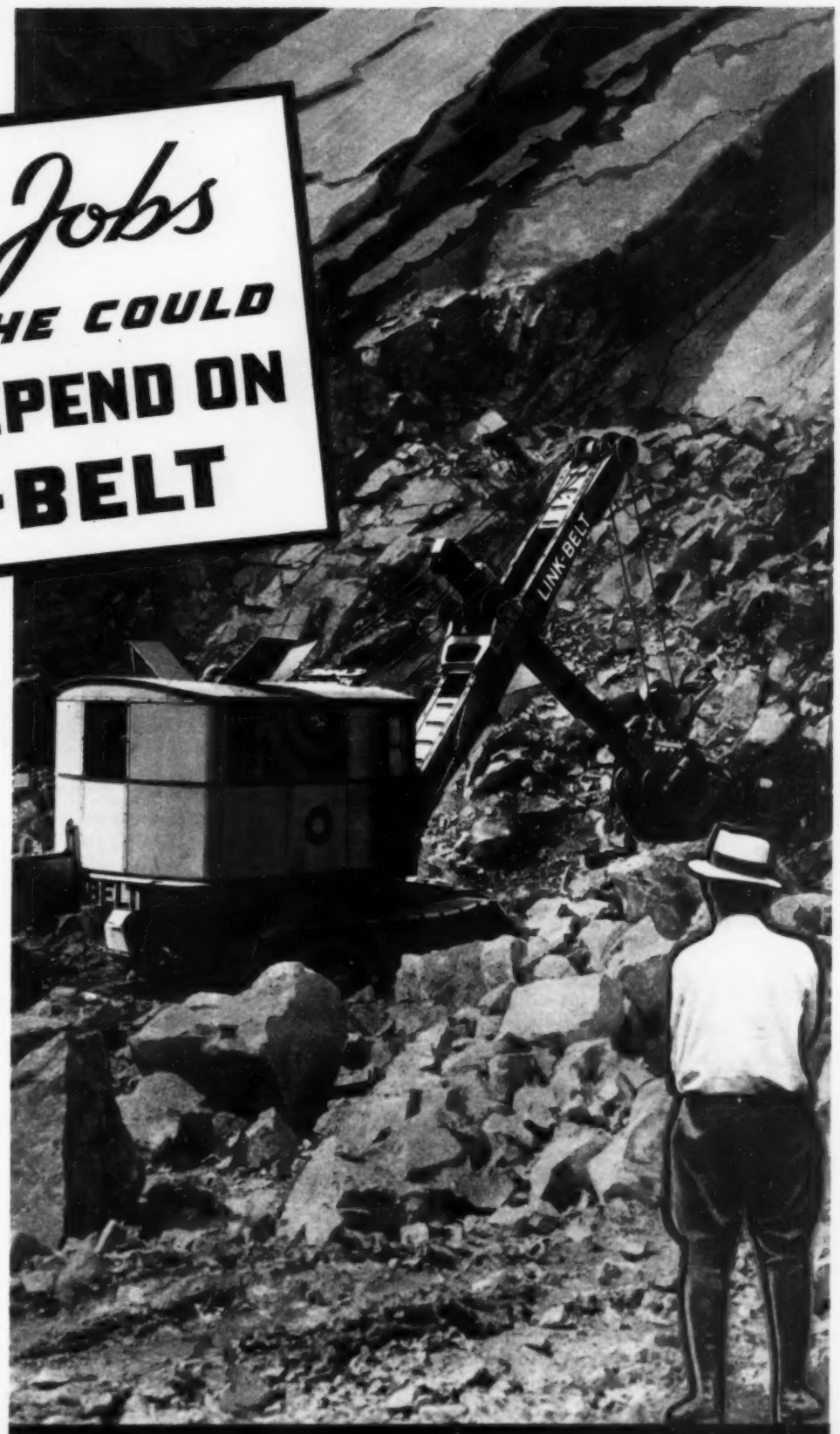


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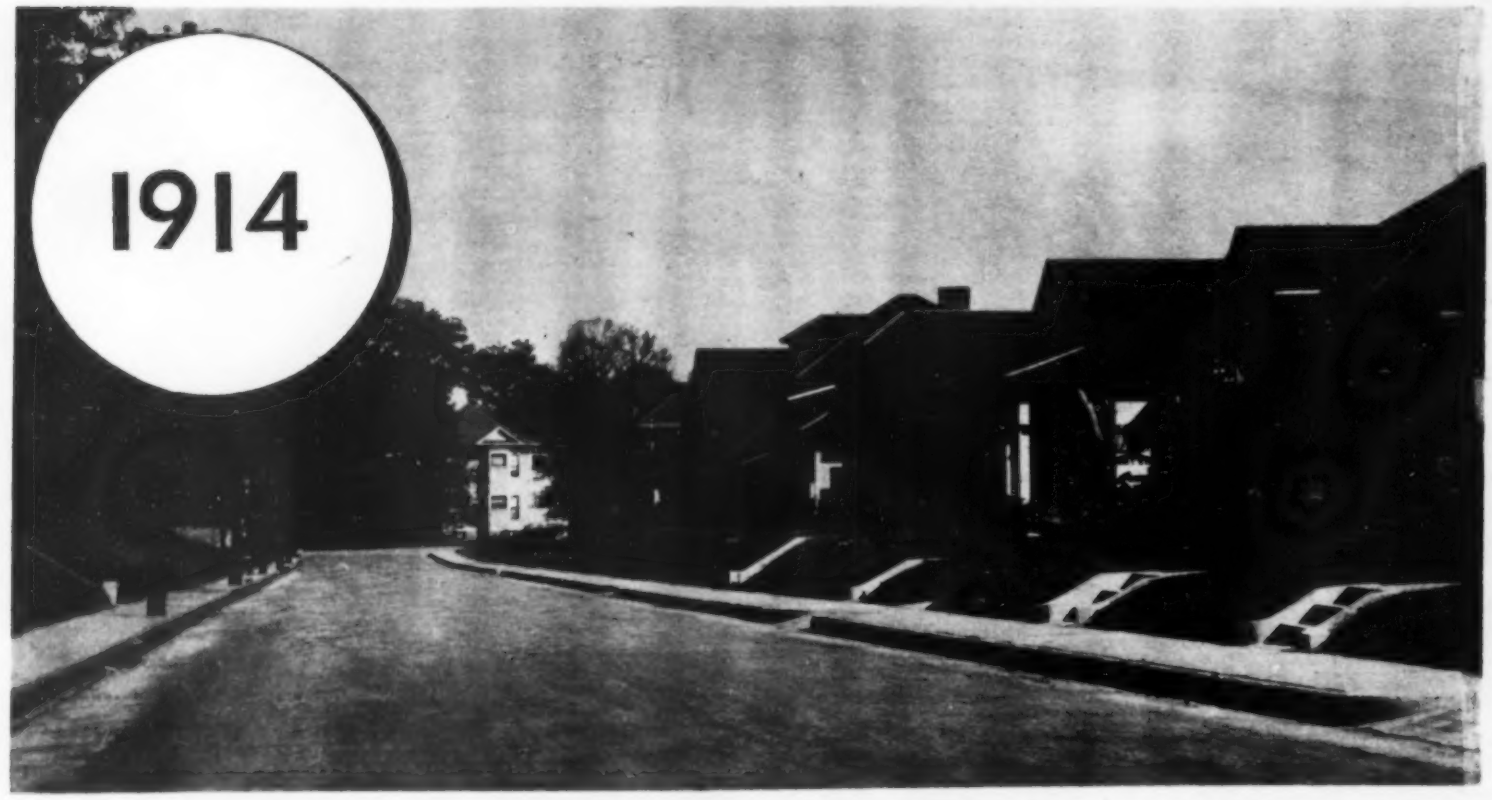

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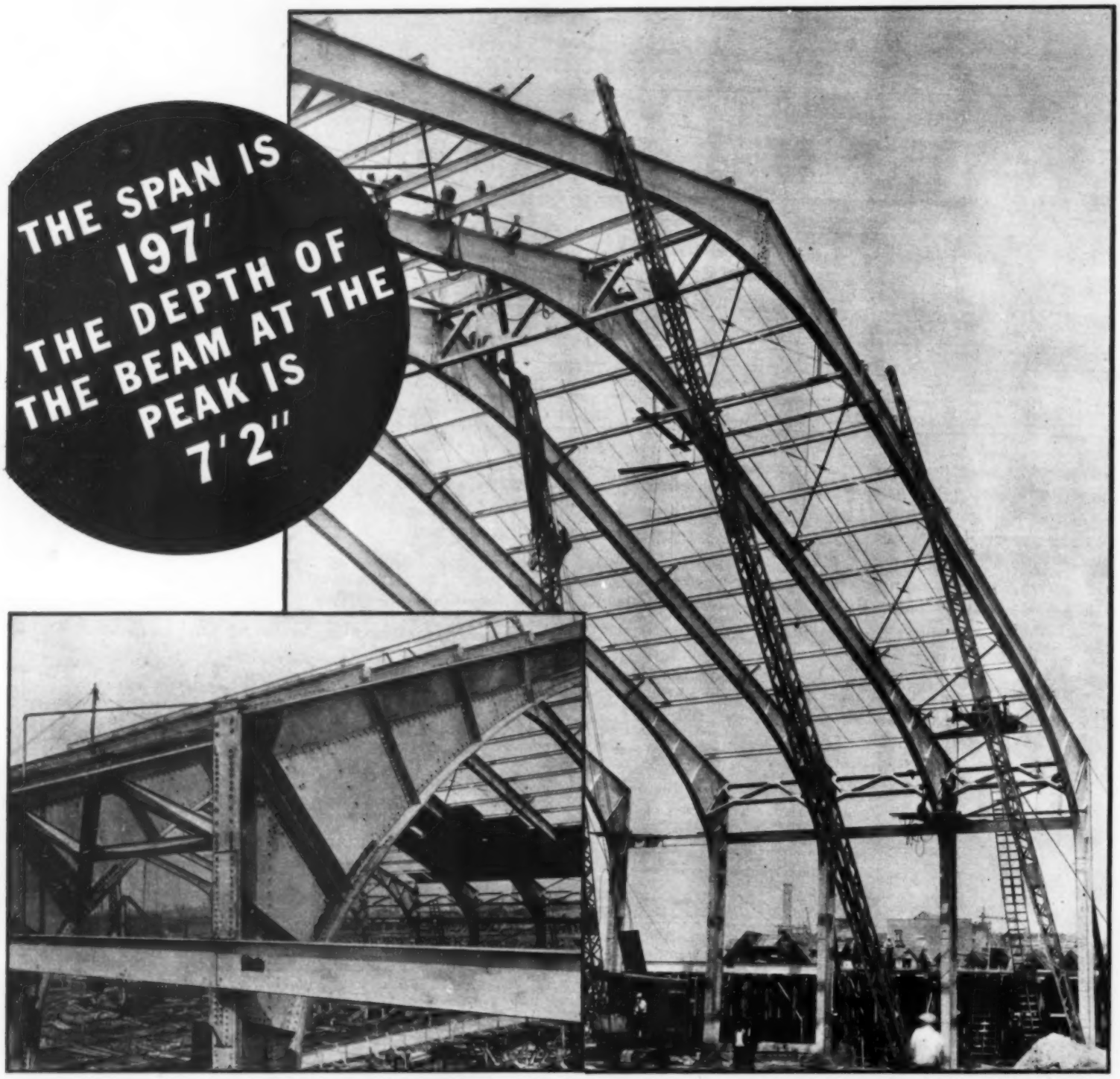


● *Eleven beam arches were used in the construction of the building. Each had a span of 197 feet, with a center height of 80 feet and a column height of 45 feet.*

● *The new International Amphitheatre of the Union Stockyards and Transit Company, Chicago. A. Epstein was the structural engineer in charge, V. McClurg co-operating. The steel was erected by Calumet Construction Company. Fabricators were Hansell-Elcock Co., Chicago.*

# NEW BEAM ARCHES *Fabricated from—*

# C B SECTIONS

● Here is striking evidence of the advantages of beam-arch construction for roofs with wide unsupported spans. A remarkable saving in clear headroom is possible. For a required height, walls can be lower and costs are reduced accordingly.

Speed of construction was another notable factor in this building. Arches were erected at an average rate of two per day—another factor in reducing costs. Additional information on the use of C B SECTIONS for beam arches may be had upon request.

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Operating almost continuously during these years (working four shifts a day more frequently than not) in rugged mountain country where the digging is all rock, the LIMAS have made commendable records. They have demonstrated speed, power and endurance to the complete satisfaction of their owner, and have proved that LIMAS equipped with roller bearings at every vital bearing point, helical cut gears throughout, independent motions, trouble-free frictions, and scores of other modern features are ruggedly withstanding the vigorous demands of the toughest jobs everywhere.

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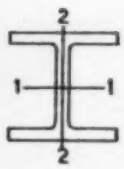
# 9 New "CBP" SECTIONS For BEARING PILES

Rolled steel has proved so efficient in bearing pile work that now we offer nine new sections developed particularly for this purpose. These complete a series of twelve sizes, as listed below. The new sections are designated by the prefix letters CBP.

You should see the data we have developed on this subject of bearing piles. To those unacquainted with this modern use of steel, these figures present convincing proof of the economy and efficiency of steel bearing piles. We welcome an opportunity of discussing this subject with you and would particularly like to point out the efficiency and adaptability of these new sections.

I

| SECTION INDEX AND NOMINAL SIZE | Depth of Section | Wgt. Per Foot | Area of Section | FLANGE | | Web Thickness | AXIS 1-1 | | | AXIS 2-2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Width | Thickness | | I | S | r | I | S | r |
| | In. | Lbs. | In.² | In. | In. | In. | In.⁴ | In.³ | In. | In.⁴ | In.³ | In. |
| CBP-146 | 14.18 | 117 | 34.42 | 15.599 | .778 | .779 | 1233.5 | 174.8 | 5.99 | 492.8 | 63.2 | 3.78 |
| 14 X 16 | 13.99 | 102 | 30.00 | 15.500 | .681 | .680 | 1060.9 | 151.7 | 5.95 | 423.1 | 54.6 | 3.75 |
| CBP-145 | 13.86 | 89 | 26.19 | 14.696 | .616 | .616 | 900.1 | 131.2 | 5.89 | 328.2 | 44.4 | 3.53 |
| 14 X 14½ | 13.70 | 73 | 21.46 | 14.518 | .538 | .438 | 762.2 | 111.3 | 5.96 | 274.5 | 37.8 | 3.58 |
| CBP-124 | 12.12 | 74 | 21.76 | 12.217 | .697 | .687 | 566.5 | 93.5 | 5.10 | 184.7 | 30.2 | 2.91 |
| CB-124 | 12.12 | 65 | 19.11 | 12.000 | .686 | .390 | 533.4 | 88.0 | 5.28 | 174.6 | 29.1 | 3.02 |
| CBP-124 | 11.78 | 53 | 15.59 | 12.046 | .437 | .436 | 394.8 | 67.0 | 5.03 | 127.4 | 21.2 | 2.86 |
| 12 X 12 | | | | | | | | | | | | |
| CBP-103 | 10.01 | 57 | 16.76 | 10.224 | .564 | .564 | 294.7 | 58.9 | 4.19 | 108.6 | 19.7 | 2.45 |
| CB-103 | 10.00 | 49 | 14.40 | 10.000 | .558 | .340 | 272.9 | 54.6 | 4.35 | 93.0 | 18.6 | 2.54 |
| CBP-103 | 9.72 | 42 | 12.35 | 10.078 | .418 | .418 | 210.8 | 43.4 | 4.13 | 71.4 | 14.2 | 2.40 |
| 10 X 10 | | | | | | | | | | | | |
| CBP-83 | 8.03 | 36 | 10.60 | 8.158 | .446 | .446 | 119.8 | 29.9 | 3.36 | 48.4 | 9.9 | 1.95 |
| CB-83 | 8.06 | 33 | 9.70 | 8.012 | .463 | .280 | 117.9 | 29.3 | 3.49 | 39.7 | 9.9 | 2.02 |
| 8 X 8 | | | | | | | | | | | | |




CARNEGIE STEEL COMPANY Pittsburgh

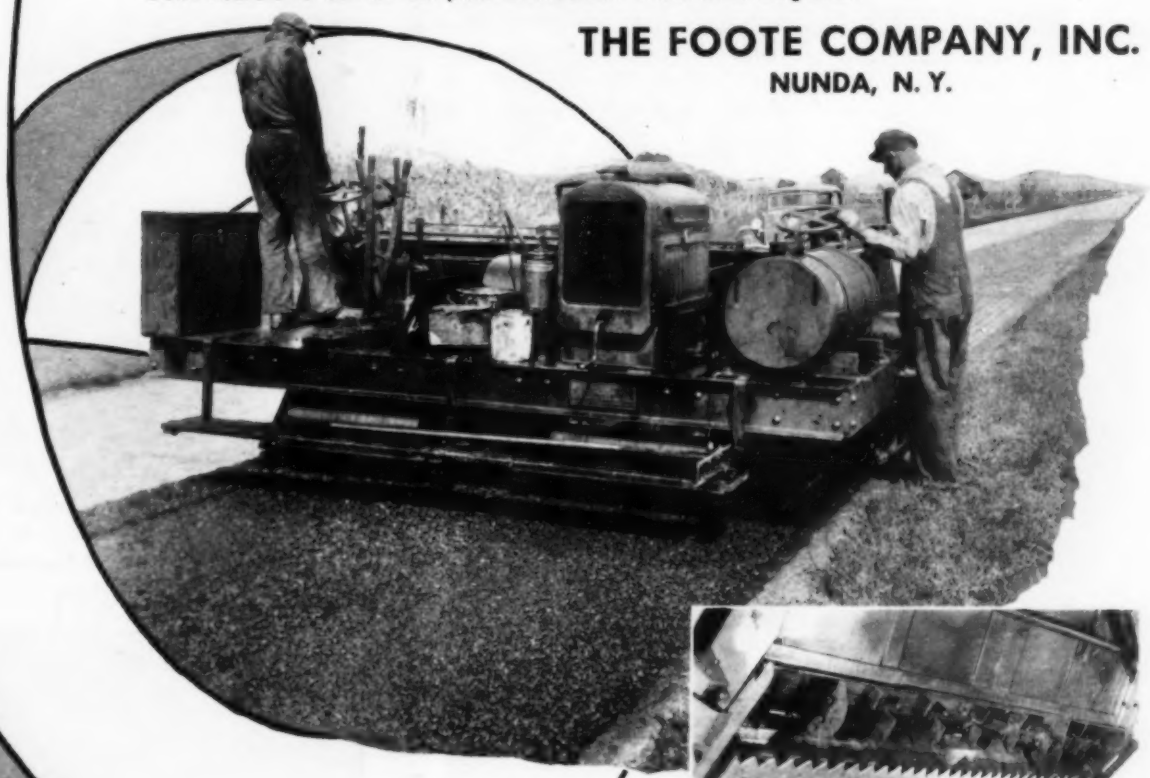
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

# 3 More for the PENNSYLVANIA HIGHWAY DEPARTMENT

There is no better testimonial than the recommendation of a machine by a repeat order from a critical and particular highway department. The fact that the Pennsylvania Highway Department now has six Adnun Black Top Pavers should be convincing evidence to the most skeptical of the ability of this machine.

If you have black top work to do you can build a better road and make more money with an Adnun. Don't hesitate to ask for complete information. There is no obligation.

**THE FOOTE COMPANY, INC.**
**NUNDA, N. Y.**

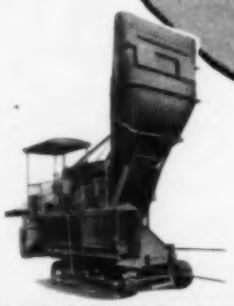


## THE CUTTER BAR STRIKE-OFF!

Many of the long list of highway officials that have approved the Adnun Black Top Paver have been surprised at the smoothness and accuracy with which it lays a road. This is the result of an exclusive Adnun feature—the Cutter Bar.

It's the cutter bar that makes possible the better road—the Adnun Road. The Adnun paver cuts the road to proper thickness leaving a course that compacts to a level, rough, non-skid surface under the roller. The cutter bar makes a perfect joint between parallel course or curbing and assures the utilization of lumpy material and all without waste. The Adnun handles any mix, lays any thickness, any width and it requires no forms or shoulder preparation.

Be sure you see an Adnun and cutter bar action.



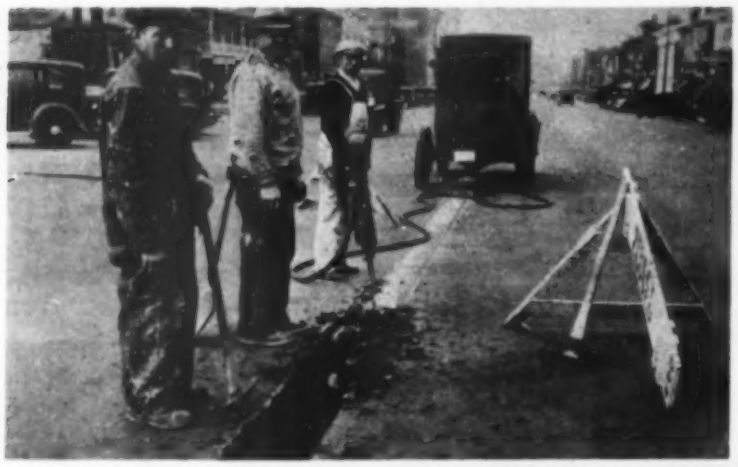
## THE MULTIFOOTE CONCRETE PAVER

For years the Multi-Foote Concrete Paver has led the field. They bring you a combination of advantages that are unbeatable for speed.

- The MultiFoote Streamlined Skip.
- The 40-second Double Cone Drum.
- The No-pressure Water Tank.
- The Power Operator.
- The Power Boom.
- The Oversize Bucket.
- Reversible 2-speed Traction and MultiFoote Simplicity.

# ADNUN BLACK TOP PAVER

# WHITE CONCRETE TRAFFIC MARKERS ARE *EASY to BUILD*



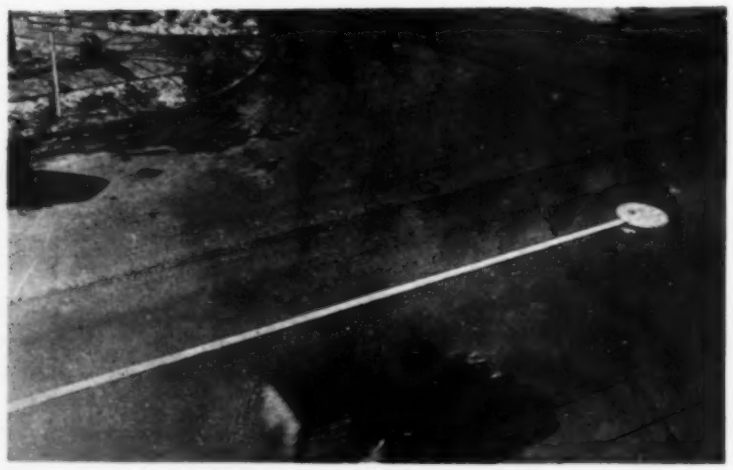
**1.** In this asphalt-paved street in Middletown, Conn., for example, guide lines were marked on pavement and asphalt cut out in 12" wide trench, down to concrete base.

**2.** The next step was to undercut the edges of the trench, on both sides, to provide a mechanical bond between the asphalt and the marker. This was a simple job.

**3.** Then a layer of gray concrete was placed in the trench, and scratched to give a good bond. Before its initial set the one-inch topping of white concrete was placed.

**4.** Next the white concrete was troweled with a steel trowel to the smooth, hard, stain-resistant surface that will keep this white marker *permanently* white.

**5.** Finally the completed white concrete marker was covered with stainless paper and a layer of straw, to allow complete curing and to prevent freezing.



**6.** And here is the completed marker. It will guide traffic efficiently, for years, with *no replacement cost.* City Engineer Allen Schaefer built it with CWA labor. (Note —while CWA stops March 31, projects like this can be carried on under the Works Division of the Federal Emergency Relief Administration—FERA.) Write Universal Atlas Cement Co. (*Subsidiary of United States Steel Corporation*), 208 South La Salle Street, Chicago, for complete information.

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## ATLAS WHITE TRAFFIC MARKERS

**Made with Atlas White Portland Cement—Plain or Waterproofed**

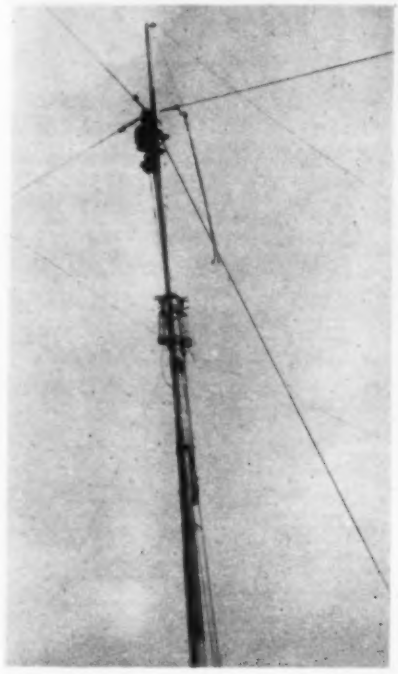
# Construction Methods

NRA CODE

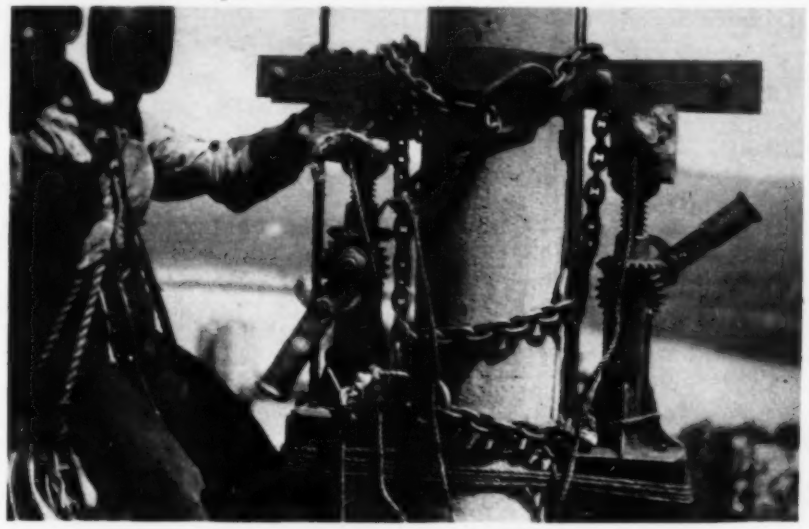
ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

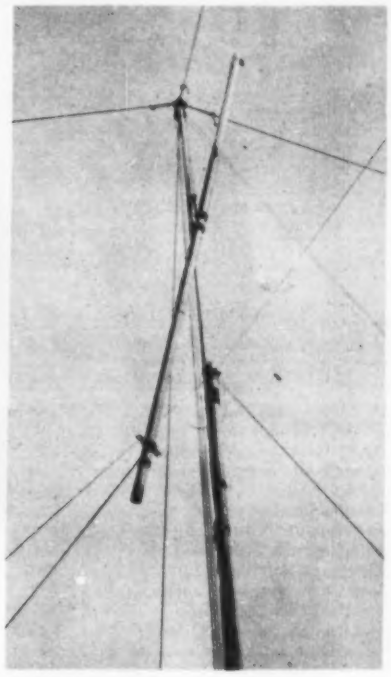
Volume 16—Number 12—New York, December, 1934

GIN POLE of 4-in. iron pipe, 45 ft. long, is lashed to radio mast below top joint.



RATCHET JACKS on wooden legs are set under bolted clamp on jointed mast section to be raised.



TOP SECTION of radio mast is loosened and lowered by tackle from gin pole.

# Special Rigging Gear

## *Dismantles 200-Ft. Radio Mast*


By L. R. TALBOT

*Contractor, Highland Falls, N. Y.*


TWO 200-ft. radio masts which had been in service at the U. S. Military Academy, West Point, N. Y., for about 8 years have just been dismantled. Each mast was made up of four 50-ft. sections of extra heavy pipe, the bottom section being 9 in. in diameter and the top, 7½ in., put together with tight-fitting socket joints.

No special clamps or other rigging, such as was used in their erection, was available. Therefore, a 45-ft. gin pole was made up of 4-in. iron pipe and equipped with a spider plate on top and a link on the bottom. This pole was raised and lashed to the mast below the top joint so that 32 ft. projected above the joint, thus allowing the upper section to be lifted just above the center.

It was apparent at the start that not enough power could be applied with a tackle on the gin pole to raise the sections out of their sockets, as neither the gin pole nor the lashings would withstand such a pull. Therefore, two 2½-ton ratchet jacks were equipped with wooden legs having an iron claw or toe on the bottom. The arrangement is shown in one of the photographs. The jacks were raised and set one on each side of the section to be raised and were supported by the claw engaging a turn of a ¾-in. cable which had been wrapped around the mast and made fast with two cable clamps. A clamp of ½x3-in. iron, with extensions to take the heads of the jacks, was bolted around the section to be lifted. As not enough friction could be obtained here, even with wedges, chains were used to grip the pipe and prevent the clamp from sliding up.

The jacks were operated by two men in "bosun" chairs, and in some cases when even the full power of the jacks would not break the joint, recourse was had to rocking the section and applying kerosene. After a joint had been given this treatment and allowed to set overnight with a strain on the jacks, it came loose in the morning.

Each section as it was removed was lowered to the ground, the gin pole was lowered to its succeeding position, and the operation repeated.

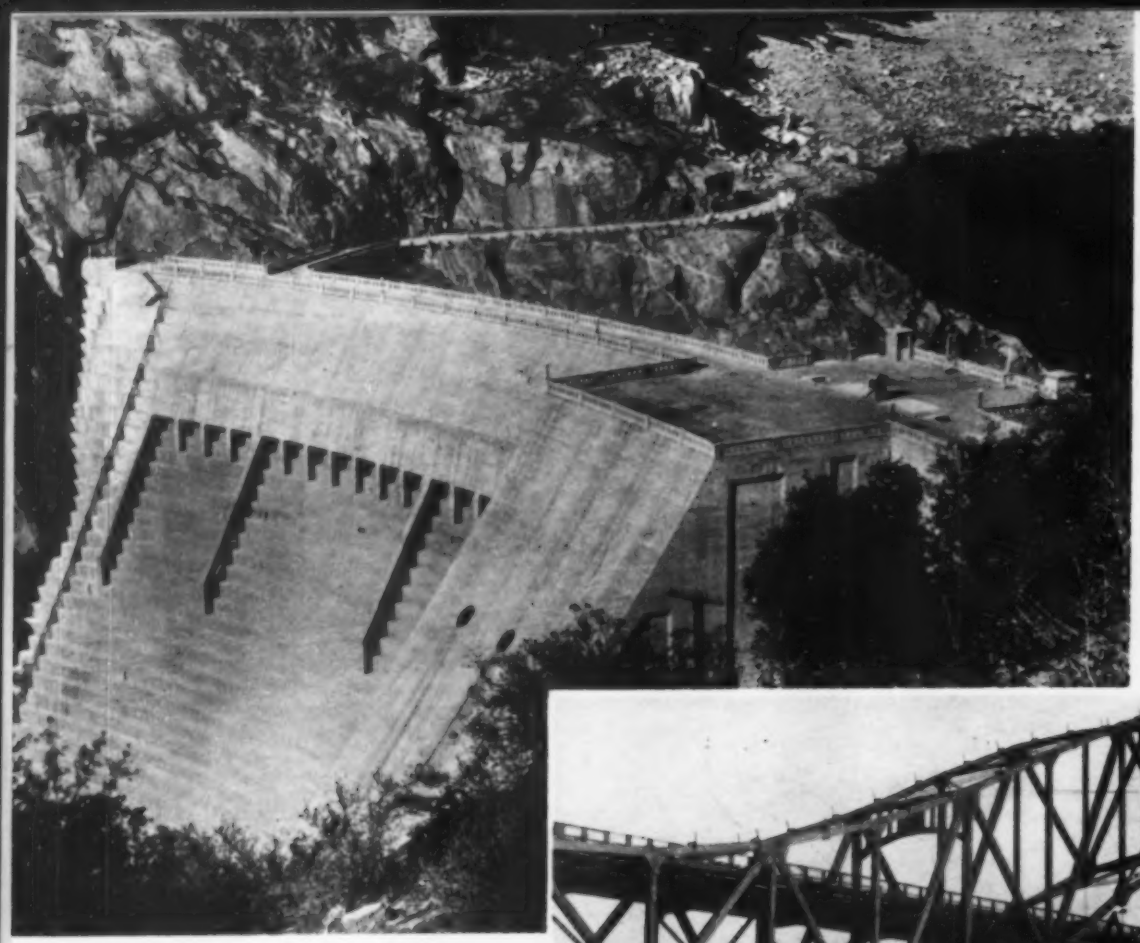
The mast sections each weighed well over a ton, and were handled by a four-part tackle on the gin pole and operated from a hand winch on the ground. Manila rope guys were used on the gin pole and the latter was lashed to the mast with the aid of ⅜-in. manila rope lashings.

DETAILS of ratchet jacks and clamp for loosening joints in mast.

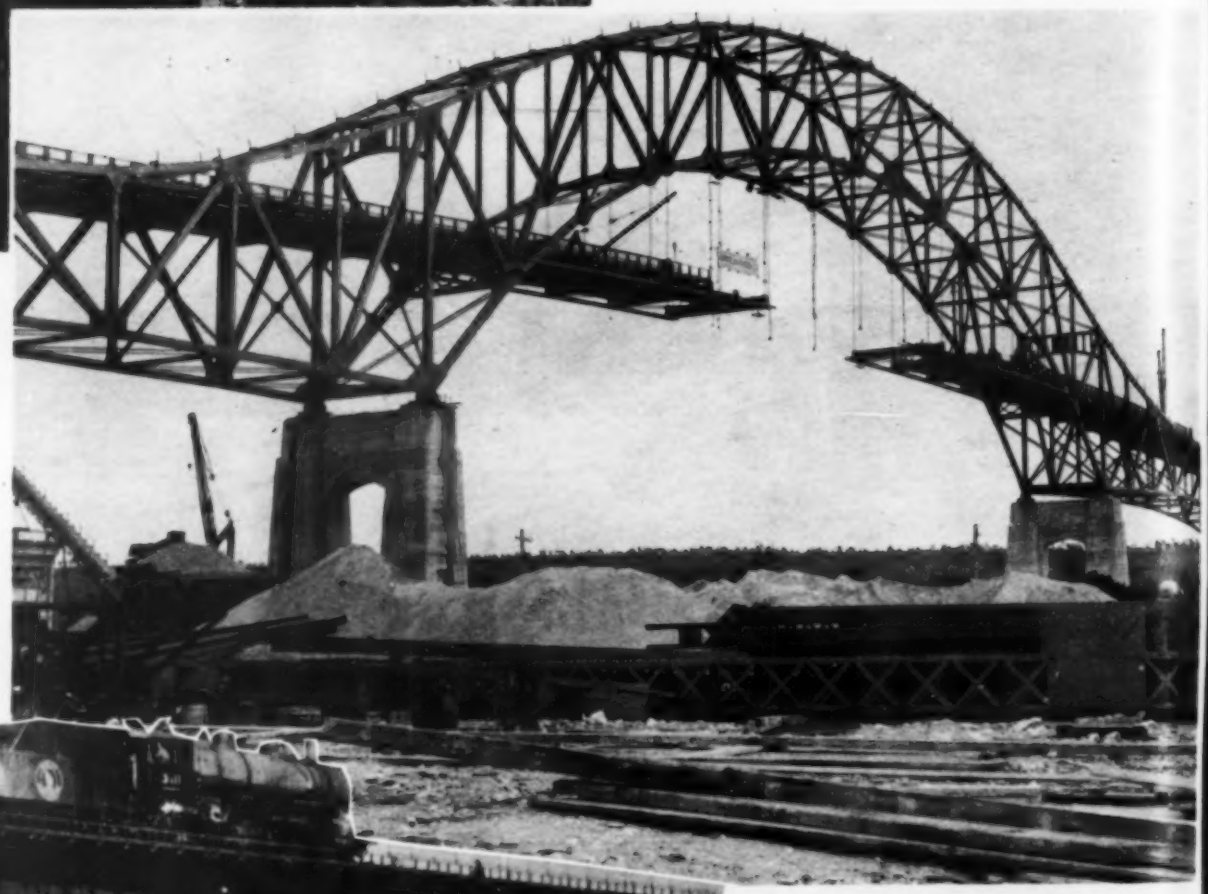
CHAINS are used to grip pipe and prevent clamp from sliding.

# *This Month's*

# "NEWS REEL"



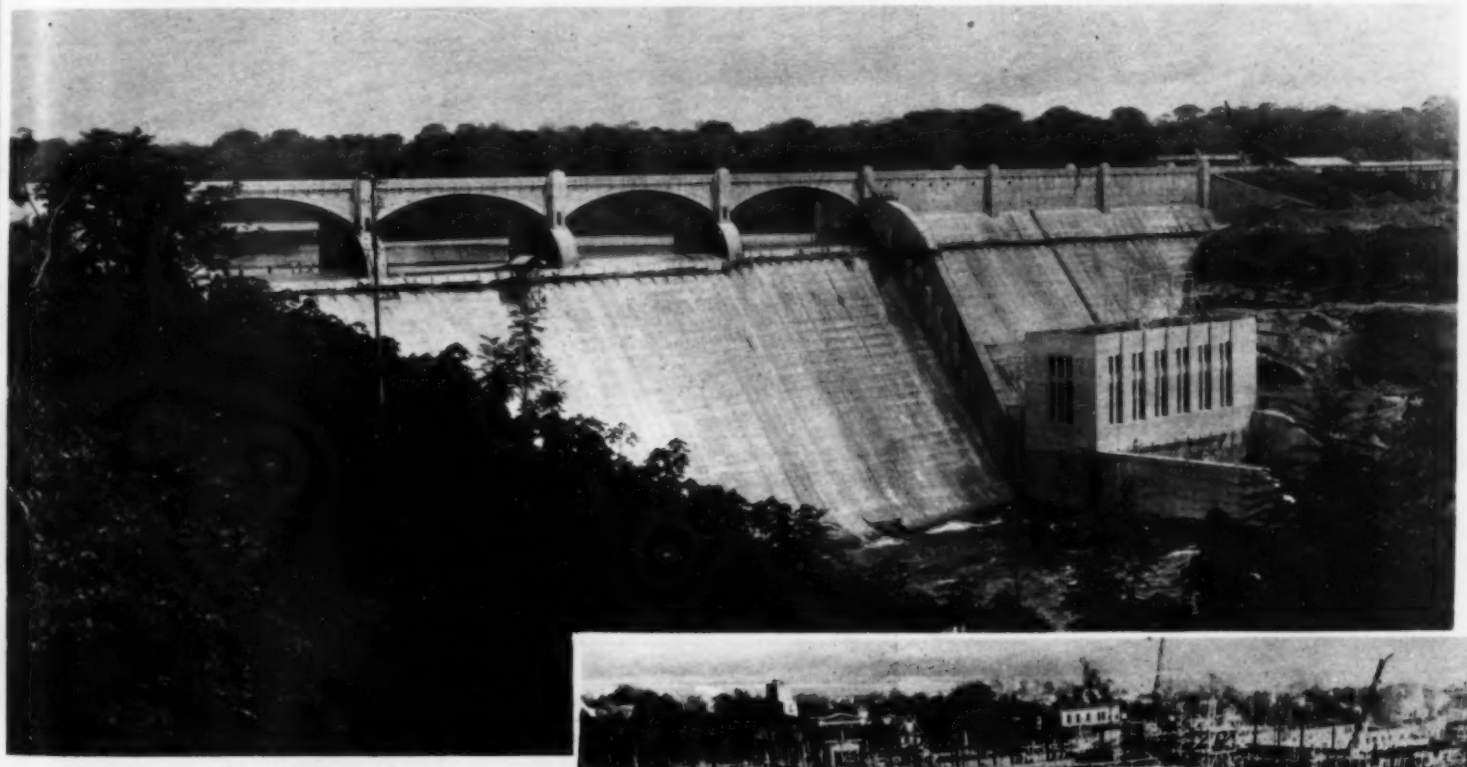
HETCH HETCHY WATER SUPPLY PROJECT for San Francisco, Calif., costing $100,000,000 and involving 155-mi. long aqueduct delivering water to city by gravity from O'Shaughnessy dam *(above)* was officially placed in service Oct. 28. The project with a capacity of 400,000,000 gal. per day, has been under construction 20 years. The dam, forming a 7½-mi. long reservoir on the Tuolumne River in Yosemite National Park is named in honor of the late M. M. O'Shaughnessy, city engineer of San Francisco and for years chief engineer for the Hetch Hetchy project. The structure (completed in 1923) is of the arched gravity, concrete type, 226.5 ft. high above original river level and 344.5 ft. high above deepest point of foundation cutoff trench. Its construction required the placing of 400,000 cu.yd. of concrete.



CAPE COD CANAL CROSSING *(above)* at Bourne, Mass., nears completion. Deck structure with 40-ft. roadway is being finished for steel arch highway bridge with main span of 616 ft., erected by American Bridge Co., under direction of Col. John J. Kingman, Corps of Engineers, U. S. Army, from designs of Fay, Spofford & Thorndike, of Boston. The bridge consists of the main span, flanked by two 396-ft. spans in a three-span continuous truss arrangement, and two simple truss approach spans at either end. Overall length of the Bourne bridge is 2,684 ft.

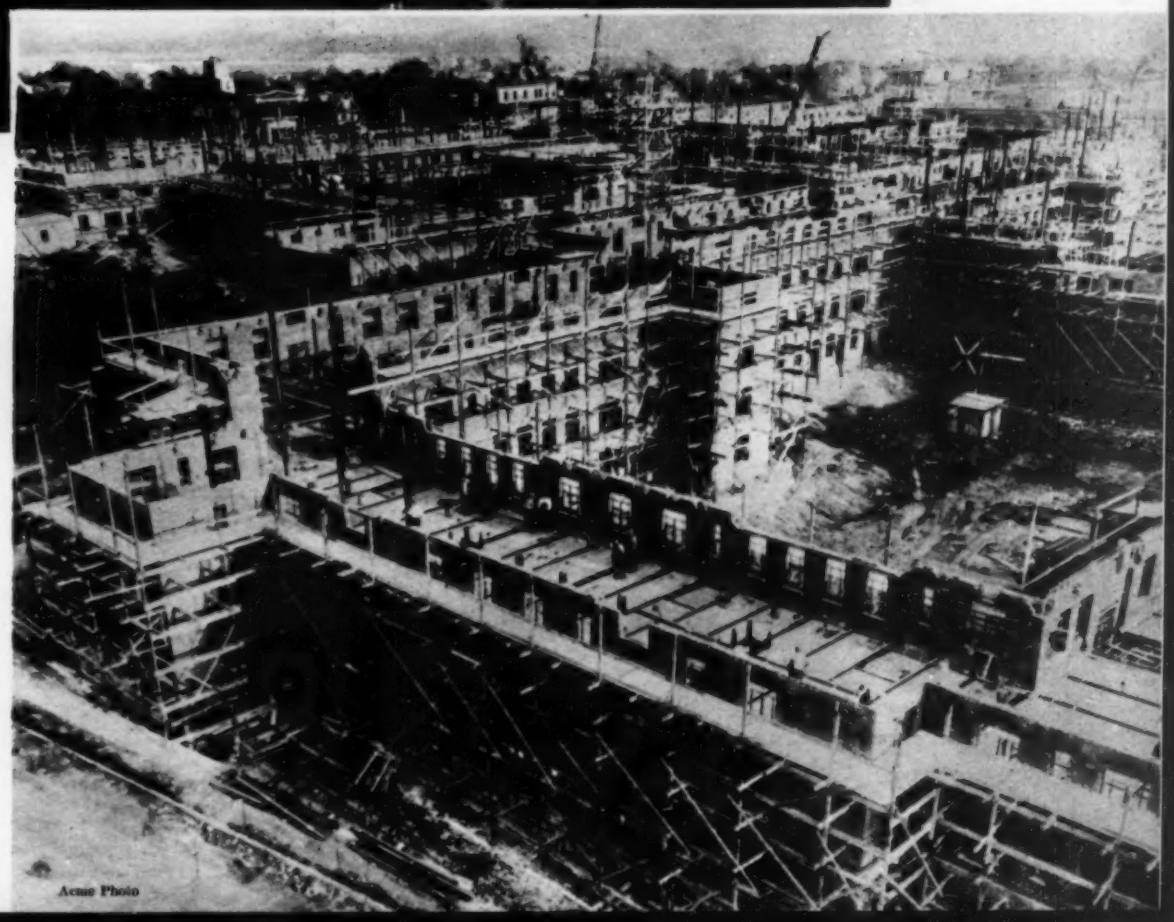
HYDRAULIC FILL *(left)* is started at Fort Peck dam across Missouri River near Glasgow, Montana. Structure forming part of $86,000,000 flood control navigation and power project, will be world's largest hydraulic fill dam, 250 ft. high, 2,700 ft. thick at bottom and 8,800 ft. long, supplemented by about 2 mi. of earth dikes. Fill will be made by pumping through 28-in. pipe lines from four cutter-head type, electrically powered dredging units having a capacity of 2,900,000 cu.yd. of material per month. The amount of earth fill in the main dam section will total 92,000,000 cu. yd., and in the supplementary dikes, 6,500,000 cu.yd. Major T. B. Larkin is in immediate charge of the project for the Corps of Engineers, U. S. Army.

**PRESIDENT ROOSEVELT INSPECTS WHEELER DAM.** Recent trip covering Tennessee Valley Authority projects discloses construction under way within huge cofferdam on Tennessee River, 15 mi. upstream from Wilson dam at Muscle Shoals, Ala. Wheeler dam containing 600,000 cu.yd. of concrete, will be 6,400 ft. long and 70 ft. high, forming lake 80 mi. long. The project involves 500,000 cu.yd. of earth and rock excavation. Construction of Wheeler dam is under direction of Arthur E. Morgan, chairman of TVA, with Lee H. Huntley serving as construction superintendent.



**MADDEN DAM COMPLETED** *(above)* in Canal Zone. W. E. Callahan Construction Co. and Peterson, Shirley & Gunther, contractors, finish 220-ft. high, 500,000-cu.yd. concrete structure in tropical jungle across Chagres River, forming reservoir to regulate floods and to supply lockage water for Panama Canal. Construction plant included aerial tramway for delivering concrete aggregates and 25-ton cableway handling 8-cu.yd. concrete buckets. R. M. Conner served as general superintendent for the contracting organization on this $4,049,000 project.

**MID - TOWN HUDSON TUNNEL**, financed by $37,500,000 PWA loan, is being built by Mason & Hanger Co., Inc., under contract with Port of New York Authority to link New York and New Jersey by subaqueous vehicular route. South tube, 31 ft. in outside diameter, of ultimate twin-tube project, will extend 6,000 ft. under Hudson River from 39th St., Manhattan, to Weehawken, N. J. It will carry two-lane roadway 21 ft. 6 in. wide. Shield-driven section under river will require 50,000 tons of cast-iron and cast-steel segments for lining the bore.



Acme Photo

**MASS HOUSING PROJECT** *(right)* takes form in Borough of Bronx, New York City. Hillside development, being built by Starrett Bros. & Eken, Inc., New York contractors, will provide 1,388 apartments containing 4,948 rooms. Limited dividend project financed by $5,060,000 PWA loan, with 30 per cent of the cost of labor and materials as a grant, is estimated to cost approximately $5,718,000.

# Well Points and Concrete Pump

**WITHIN WALKING DISTANCE OF MANHATTAN'S FINANCIAL DISTRICT and under shadow of Brooklyn bridge, great apartment-house project financed by Reconstruction Finance Corp. clears two blocks of unhealthful tenements and builds modern residence community for 1,600 families. Central mixing plant is erected in playground area between two projected buildings. Trucks back up long ramp to dump into overhead bins.**

PIPE LINES to collect water from well points and other pipe lines to convey pumped concrete from a central plant were the distinguishing features of foundation operations at Knickerbocker Village, on the lower East Side of New York City, a great slum-clearance project completed Dec. 1 by the Fred F. French Co., for Knickerbocker Village, Inc. The project replaced with two modern, fireproof apartment houses 104 previously existing tenements on a 5-acre plot which had been appropriately known as the "Lung Block" because of the high ratio of pulmonary diseases suffered by tenants within its unhealthful confines. The two new houses occupy 44 per cent of the land and provide 1,630 apartments containing more than 6,000 rooms, which rent at an average rate of $12.50 per room. This average rental is permitted for projects in Manhattan by the State Housing Law under which Knickerbocker Village, Inc., was chartered as a limited-dividend corporation. The project has been financed principally by a mortgage loan for more than $8,000,000 from the Reconstruction Finance Corp.

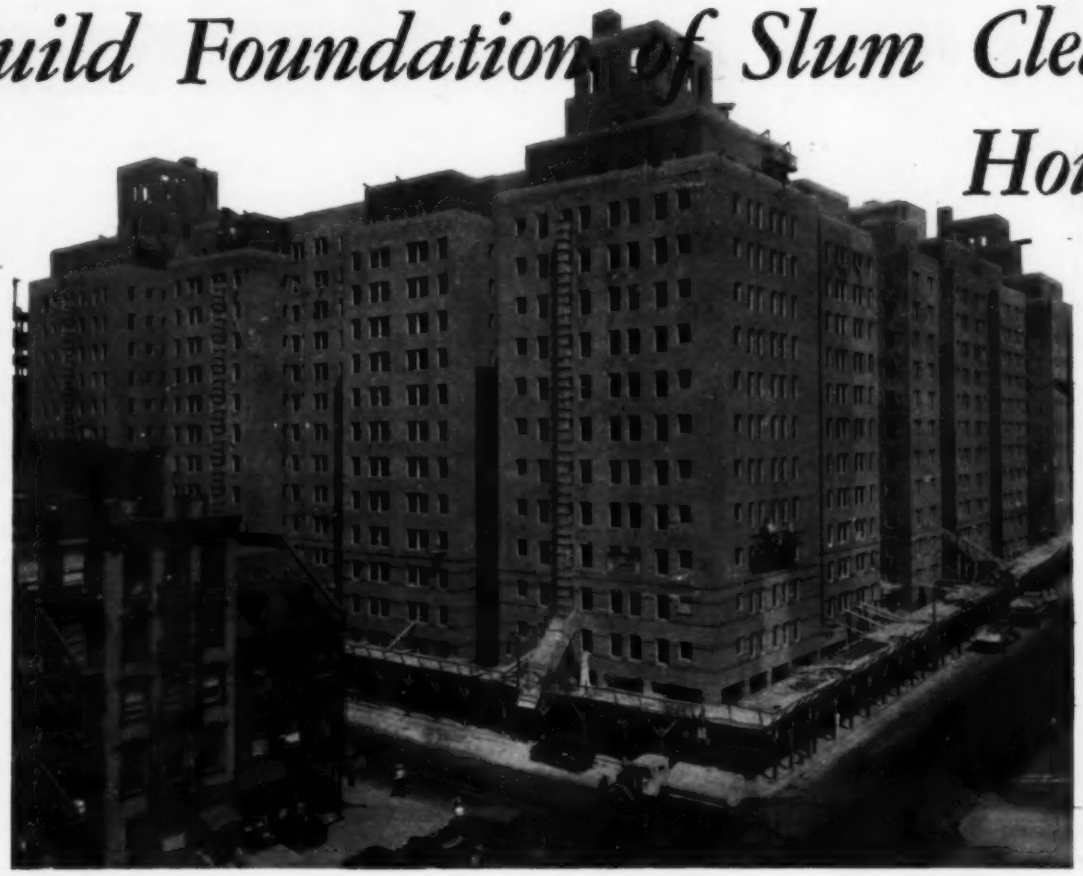
**POWER SHOVELS remove last vestiges of 104 tenement buildings and start foundation excavation for two 12-story elevator apartment houses containing more than 6,000 rooms.**

*Plot Plan* — Outside dimensions of the plot and a rough layout of the two buildings are indicated on the accompanying plan. Each structure surrounds a large interior court, and the two buildings are separated by a playground 88 ft. wide, under part of which is located a boiler plant to serve the entire community.

With the exception of a central 9-story section facing Catharine St., the buildings are 12 stories high. An additional pent-house floor provides for apartments with terraces. The buildings are of steel-frame construction on concrete spread footings resting on sand. Typical New York City fireproof construction is employed throughout the structures, which have cinder-concrete floor arches, brick exterior walls, and interior partitions of hollow tile and gypsum block.

*Foundation Conditions* —Test bor-

# Build Foundation of Slum Clearance Housing Project



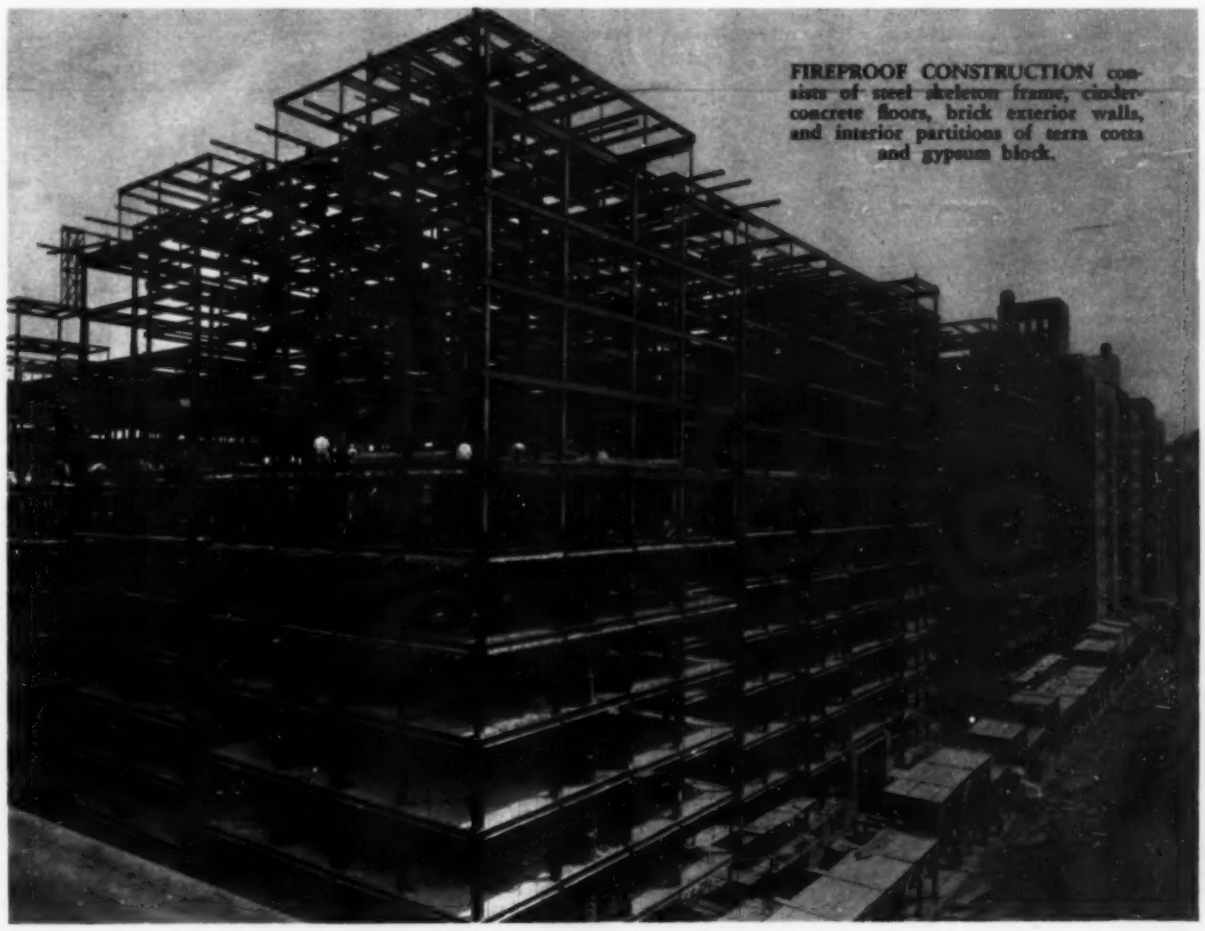
**EAST BUILDING** is first unit of project to be erected. On June 22, structure has been completely inclosed with brick exterior walls. Work progresses rapidly toward completion on Oct. 1, when building is to be ready for occupancy.

ings indicated that a fine sand with a safe bearing capacity of 2 tons per square foot could be uncovered at depths varying from about El. -2 for the East Building to about El. -13 for the footings adjacent to Catharine St., under the West Building. Curb levels on the streets surrounding the plot vary from El. 6.5 at the corner of Cherry and Catharine, to El. 21 at Monroe and Market. Groundwater level at the site, which is close to the East River, varied between sea-level datum and El. -1. In addition to the spread footings for the two buildings, it was necessary to excavate to El. -16.4 for the foundation mat under the boiler room and about to El.'s -15 and -11 for ejector pits under the interior courts of the West and East Buildings respectively.

According to the test borings, an area roughly trapezoidal in shape, adjacent to Catharine St., measuring 40 ft. along Cherry St. and about 100 ft. along Monroe St., contained a section of old bog which necessitated excavation to maximum depths of about El. -13.5 to reach sand. This condition was expected to delay foundation construction on the West Building, and the builders accordingly planned to complete the footings of the East Building in advance of the West and to finish erection of the East steel frame while billets were being placed for the West structure. This plan, which was followed in executing the work, met an unexpected delay when actual excavation disclosed a clay deposit overlying sand along Market St., adjacent to Cherry. This clay formation, which had not been revealed by the test borings, required excavation to El. -13 at the southeast corner, under unit F of the East Building.

*Excavation and Drainage* — A subcontract for the excavation of about 125,000 yd. of material to foundation levels was awarded to the Godwin Construction Co. The subcontractor utilized 240 Moretrench well points and eight Moretrench 6-in. pumps to drain the sandy soil around the areas of the deeper foundations such as the boiler room, the ejector pits, and the footings in the west end of the plot, along Catharine St. This drainage system was relied upon to draw down the general groundwater level sufficiently to permit excavation of the shallower piers, as the sandy soil permitted flow of groundwater on a fairly flat gradient. Except for the unexpected deep foundation at the southeast corner, which later was drained by means of a sump, this plan proved effective. When the entire well-point system was in operation, it pumped an estimated volume of 7,500 g.p.m. into the sewers.

Before installing the well-point system, the subcontractor excavated close to groundwater level at El. 0.0. For the foundation mat under the boiler room, which rests on sand at El. -16.4 and covers an area about 70x175 ft., the Godwin Construction Co. laid two lines of 6-in. headers surrounding the site at a distance of about 20 ft. from the edge of the mat. Well points were connected to each header at intervals of 3 ft. for most of the distance around the area, making the average spacing between well points 1½ ft. at most



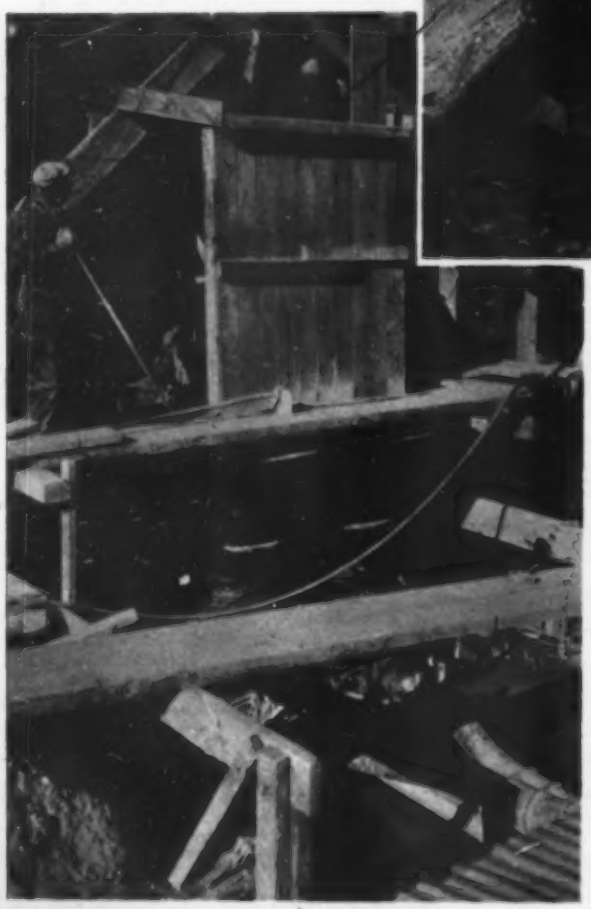
**FIREPROOF CONSTRUCTION** consists of steel skeleton frame, cinder-concrete floors, brick exterior walls, and interior partitions of terra cotta and gypsum block.

TWO HUGE ELEVATOR APARTMENT BUILDINGS rise above surrounding slums near East River. In background are approach ramps leading to Manhattan Bridge. SAND SPOIL *(right)* from foundation excavation is loaded by power shovel for removal.

been completed, workmen placed heavy timber wales, or breast pieces, braced by stout timbers from the inner piers, and drove close wood sheeting with air hammers to retain the streets before excavating next to the sidewalks.

Five 1⅜-yd. and 1½-yd. Thew-Lorain gasoline shovels excavated to within 1 ft. of footing grades, wherever possible, to reduce to a minimum the final excavation by crane and by hand. Several of the shovels were converted to cranes as excavation approached the desired levels. During the first month, excavators worked two 8-hr. shifts per day, loading as much as 2,400 yd. per shift into trucks of 8-yd. capacity. A fleet of ten or twelve trucks took care of this amount of excavation on a short haul to a pier where they dumped into scows. Two Northwest cranes were brought on to the project later to replace shovels moved to other sites.

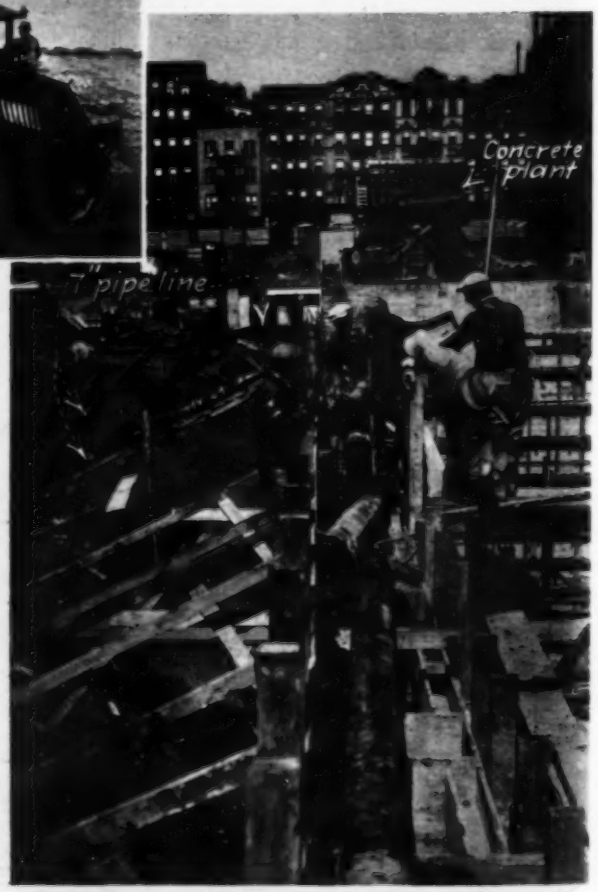
*Foundation Concrete*—As a central site for mixing and pumping 18,000 cu. yd. of concrete required for foundations, the Industrial Engineering Co., subcontractor, selected the north end of the playground area between the two apartment houses. This site for a plant offered a truck entrance from Monroe St. and encroached upon none of the foundation structures. At this location, the contractor erected a long timber ramp for truck delivery of concrete ingredients and arranged the plant for operation by gravity from bins to batchers to mixers to concrete pump. By means of the pump and a 7-in. pipe line, the Industrial Engineering Co. de-



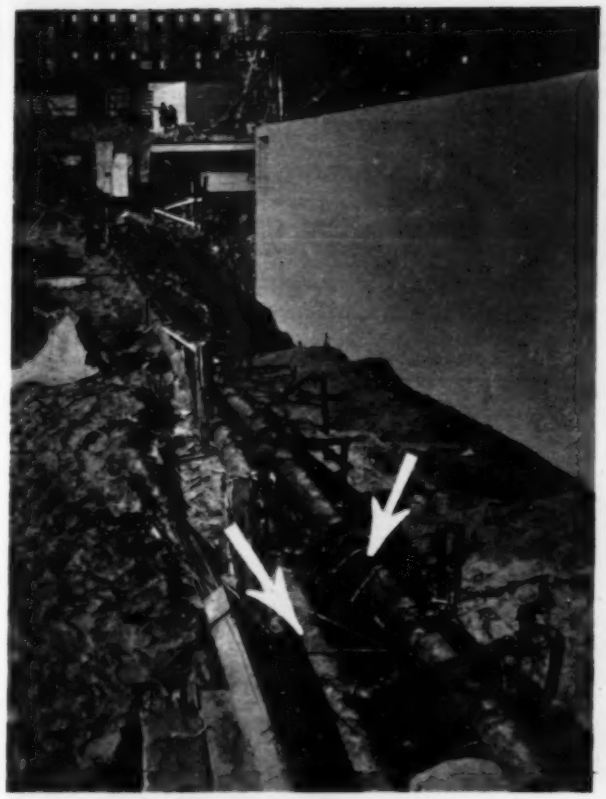
DOUBLE-CHAMBERED CONCRETE PUMP receives concrete from 1-yd. mixer and delivers material through pipe line to foundation structures in all parts of plot.

places around the four sides. The well points, 22 ft. long, were installed by jetting with a special three-stage centrifugal jetting pump provided for the purpose. Close spacing of the well points around the boiler room proved effective in holding the groundwater level below El. -16.4. By using well points, the contractor dried out the sandy soil and excavated in the open, without the use of steel sheeting, which otherwise would have been necessary. The dry banks surrounding the area were safely sloped on angles of about 45 deg.

Well points were similarly successful in draining the deep foundation area at the corner of Catharine and Monroe Sts. In constructing these and other footings, adjacent to the streets, the contractor followed a plan of first completing the inner footings, leaving banks of safe slopes to support the streets. After the inside footings had




PUMPED CONCRETE from central mixing and pumping plant is delivered through 7-in. pipe to boiler-room wall forms. Line is quickly extended by adding 10-ft. sections equipped with toggle-type couplings.



TWO LINES OF WELL POINTS connected to 6-in. headers (indicated by arrows) 20 ft. from boiler-room walls drain sandy soil to permit construction of concrete mat more than 16 ft. below groundwater level.

DEEP FOUNDATION EXCAVATION at southeast corner of plot (to remove clay deposit undisclosed by preliminary test borings) delays steel erection for Unit F of East Building.

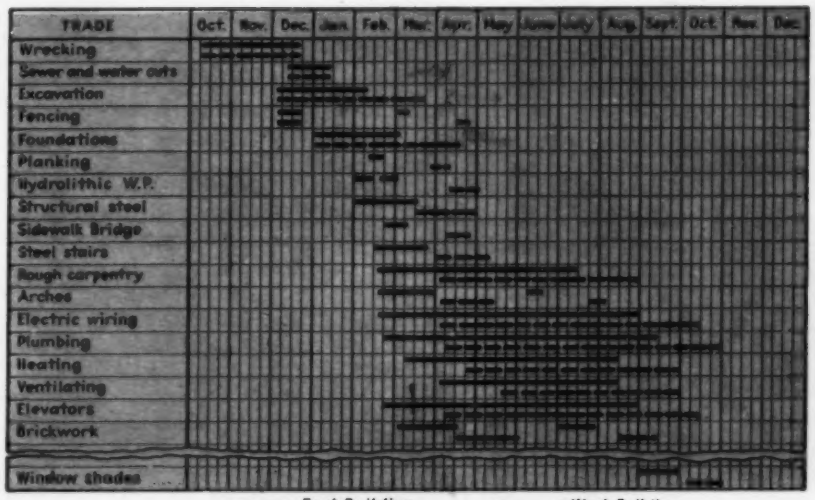
livered concrete at rates as high as 50 cu.yd. per hr. to all parts of the plot. A Ransome 1-yd. gasoline-powered mixer prepared the foundation concrete.

From the mixer, the concrete discharged into the two hoppers of a Rex Pumpcrete double-chambered reciprocating concrete pump, operated by a gasoline motor. Two slowly moving, reciprocating pistons in the chambers of the pump forced the concrete through the 7-in. pipe line maximum distances of 500 to 600 ft. horizontally plus 15 to 20 ft. vertically at rates approaching 50 cu.yd. per hour. The pipe line frequently included four to six right-angle bends, made up of one 90-deg. pipe section or two 45-deg. pipe sections, 10 ft. in length. To one portion of the foundation mat under the boiler room, the pump delivered 700 cu.yd. of concrete in 14 hr. of continuous placement. The pump handled concrete of 3-in. and 4-in. slump and mixtures of much thinner consistency. Pipe sections 10 ft. long were quickly added to or detached from the pipe line by means of the toggle-type couplings, equipped with handles for ready manipulation.

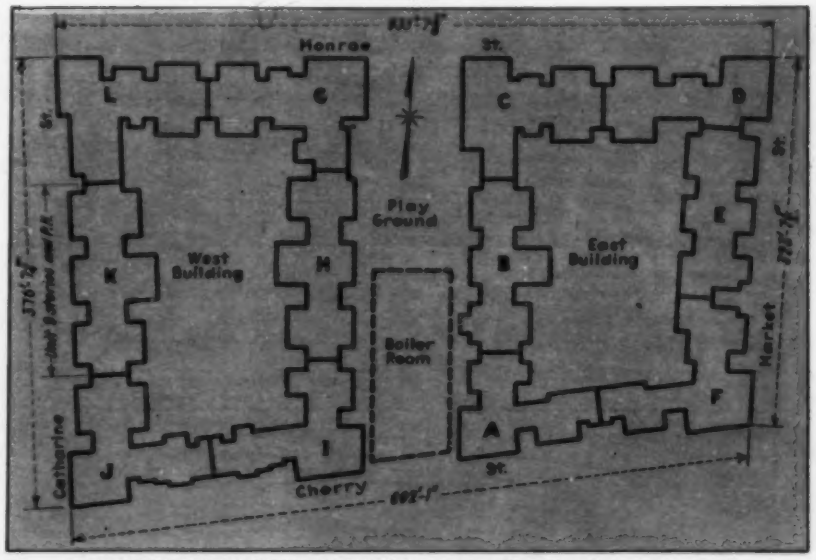
*Steel Erection*—A total of 8,500 tons of steel in the structural frames of the two buildings was erected by the Harris Structural Steel Co., subcontractor, with eight guy derricks on each of the two structures. Nothing unusual was involved in the erection procedure.

*Superstructure Masonry* — For purposes of construction, each of the two buildings was divided into quarters, with two inside hoists in each quarter for brick, driven by 80-hp. electric hoist engines. The interior court of each apartment house was planked over for trucking and was provided with an entrance through the apartment house from Cherry St. and with an exit on to Monroe St. Each court contained two concrete mixing plants in diagonally opposite corners, equipped with inside hoists for delivery of concrete to upper floors. Overhead bins of the mixing plant in the East Building were charged directly by trucks which climbed ramps to attain sufficient elevation. In the West Building, the bins were fed by bucket elevators — a method which proved more satisfactory and economical. A contract for 1,200,000 sq.ft. of cinder-concrete floor arches and cement finish was executed by the Washington Concrete Corp. The Fred F. French Co. built the brick walls and partitions. These items called for 12,000,000 brick and 1,800,000 sq.ft. of hollow-tile and gypsum-block partitioning.

*Progress* — By agreement with the Reconstruction Finance Corp., construction operations were limited to 40 hr. per week, and each workman was restricted to 30 hr. per week. An exception in the length of the working week was made for excavation, which was allowed to proceed for 80 hr. per week, although the hours of each workman were limited to 30. In keeping with the agreement, all other operations proceeded on a schedule of 8 hr. per day, 5 days each week, Monday to Friday, inclusive. Workmen were kept well within the limits of the agreement by operating two shifts. One shift worked Thursday and Friday of one week and Monday, Tuesday and Wednesday of the following week. It then took a week off, while the second shift carried the work forward on the same schedule. A maximum list of 6,000 names was carried on the complete payroll for the two shifts.




ORIGINAL PROGRESS SCHEDULE is adhered to as closely as circumstances permit. In spite of foundation difficulties, East Building is completed and occupied Oct. 1. Occupancy date for West Building is set back one month to Dec. 1.

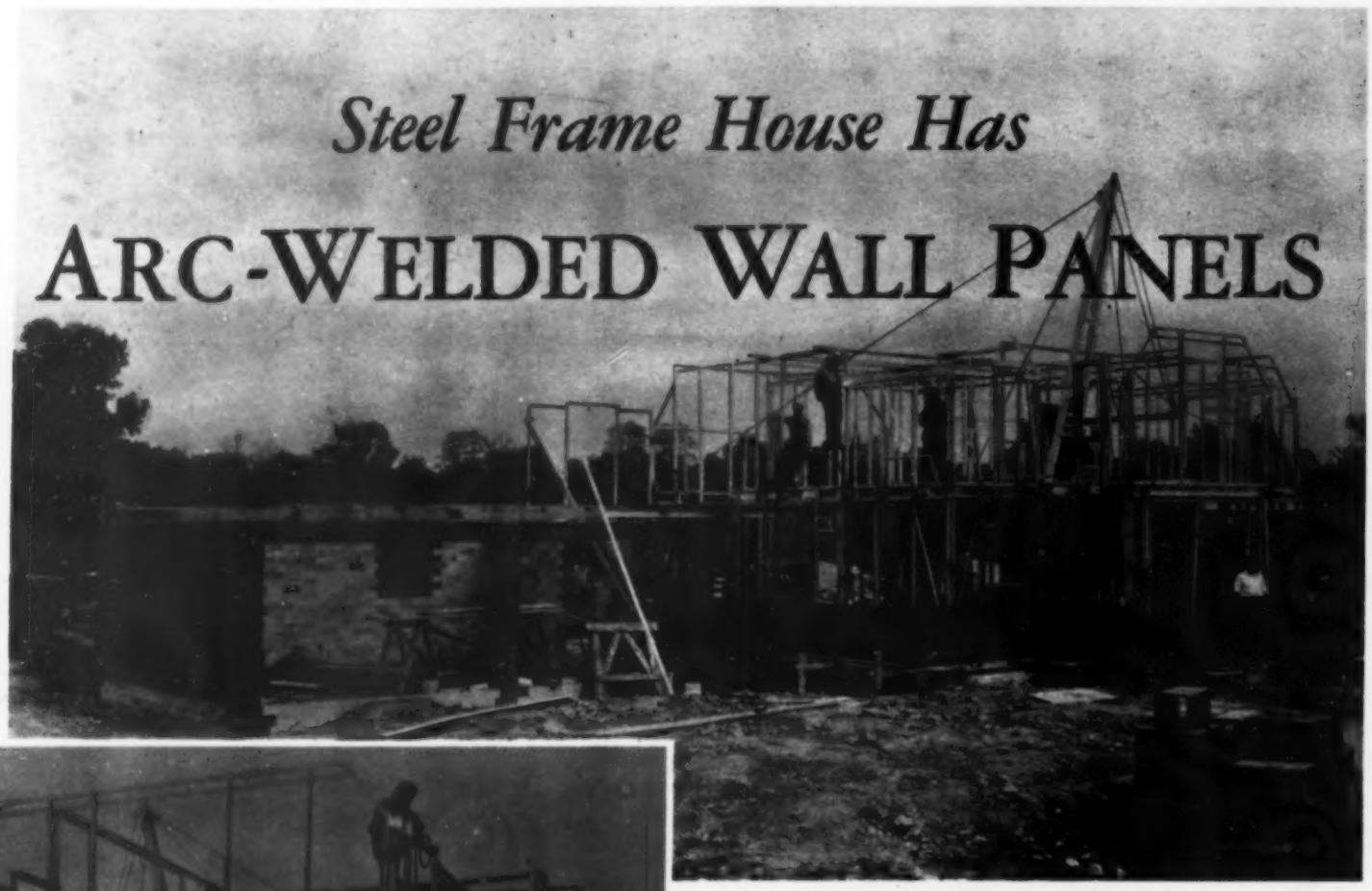



TWO APARTMENT BUILDINGS surrounding interior courts and separated by 80-ft. playground occupy 44 per cent of 5-acre plot. Except for Unit K of West Building (9 stories and penthouse) structures are 12 stories high, exclusive of penthouse floors.

*Administration* — The project was conceived, initiated and carried through to a successful conclusion by Fred F. French, head of the Fred F. French Co. and of Knickerbocker Village, Inc. For the Fred F. French Co., F. D. Foss was project manager, and H. A. Harris was general superintendent. John S. Van Wart was the architect. Kenneth Franzheim, supervising architect, and William Wilson, supervising engineer, represented the Reconstruction Finance Corp. and the New York State Board of Housing, respectively.

# *Steel Frame House Has*

# ARC-WELDED WALL PANELS



**LARGEST SINGLE STEEL-FRAME HOUSE erected entirely by shielded-arc process of welding.**

**ELECTRIC ARC welds framework of 12-room structure into one single piece.**

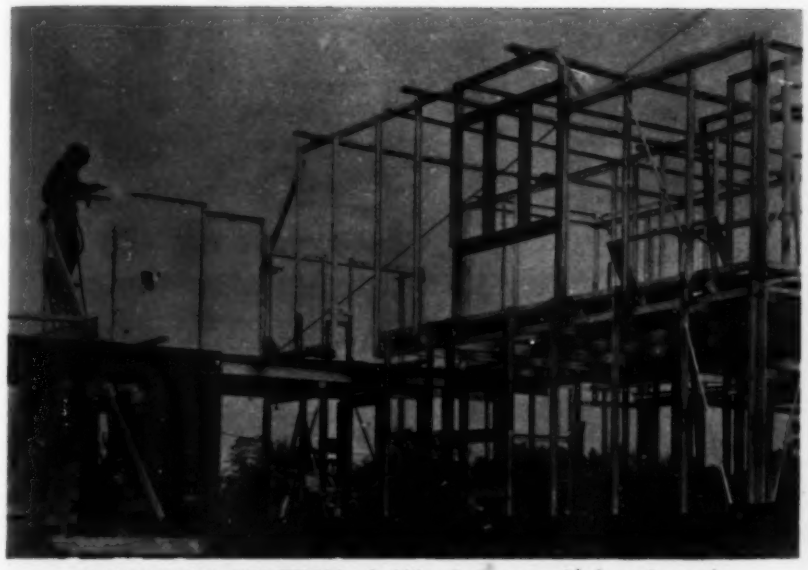
THE LARGEST single steel-frame house thus far built, and one of the first of its type in which arc-welded construction has been used throughout, has been erected in the exclusive Ottawa Hills section of Toledo, Ohio, for O. C. Rohde from designs prepared by Myron T. Hill, Toledo architect. Fireproof construction, greater stiffness and rigidity as well as higher speed of assembly, are all provided for by the design of the arc-welded steel frame.

This 12-room residence has a total volume of 53,450 cu.ft. The spread of the house with connecting garage is about 83 ft. with a depth 35 ft. The front door leads into a flagstone-paved vestibule, and up two steps into the main hall from which the living room, 15 ft. wide by 24 ft. long, is reached through an arched opening. The dining room and study are also reached from the stair hall. Four bedrooms and two bathrooms comprise the second floor of the house. The basement contains a recreation room, a completely equipped owner's workshop, and a boiler room containing heating and air-conditioning equipment.

The walls of the house are composed of large panels one story in height,

**PLACING WELDED PANEL which was delivered fully fabricated by arc-welding and ready for welding in position.**

**WHOLE SECTIONS replace pieces in modern arc-welded house frame construction. Only 45 panels were required in entire wall frame of house.**



COMPLETING ERECTION of 44th of 45 arc-welded steel panels comprising 46 per cent of all-welded framework of Toledo's modern dwelling.

STEEL CARPENTER uses only one tool—the electric arc—in erecting entire steel framework of today's fireproof home.

assembled by shop welding. These panels were fabricated from standard 3-in. 4.1-lb. channels, as studs, and angles, plates, etc. as necessary. A total of 45 panels were used in construction, the largest being 10x20 ft. The first floor panels have a continuous 3-in. channel sill as base and a continuous girt angle at the top to receive the second floor channels. The second floor panels have a girt angle base which rests on top of the second floor channels. Top girt angles are 2½x2¼-in., while bottom girt angles are 3x2½x¼-in. The channel studs of both panels overlap, so that a field weld could be made to the opposite girt angle, giving a continuity of wall construction.

In erecting the house, the first step was accurate placing of bearing plates and anchor bolts. All plates were brought into alignment and grouted solidly in place on the 12-in. load-bearing tile basement wall. A minimum of two bearing plates were placed under each panel. Wall panels were subsequently welded to all bearing plates.

The next step was to set the first-story wall panels and bolt them together at the panel intersections with ½-in. bolts which were used only for assembly. The first floor channels were next set, bearing directly on the 3-in. channels which acted as sills. Floor channels and wall panels were then aligned, plumbed and welded. After the wall panels had been welded to the bearing plates continuous grouting was placed under the channel sills to obtain continuous bearing.

The next step of erection was to place the second-floor channels. The second-floor wall panels were then bolted together at the panel intersections. The floor channels were welded to both first and second-story girt angles. Extended studs of the first story were welded to the second-story girt angles and the second-floor studs were welded to the first-story angles. The second-story wall panels were then welded and the third-floor beams set, brought into alignment and welded.

A clear, unobstructed passage in the wall for all ducts, pipes and conduits was provided by placing all girt angles on the interior of the frame, except at the eave.

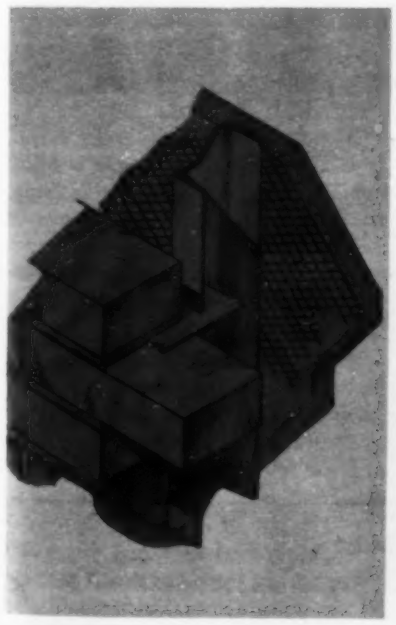
All welding, both in the shop and field, was done with the shielded-arc process, using welding equipment manufactured by the Lincoln Electric Company, Cleveland, Ohio. Quarter-inch fillet welds were used almost entirely. After welding, all welds, as well as the steel, were covered with aluminum paint.

Standard 6-in. 8.2-lb. channels, spaced 3 ft. to 3 ft. 6 in. on centers, carry the floor construction. A ¾-in. rib lath, which acts as a form for concrete and also as reinforcement in the concrete floor slab, was secured to the top of the channels. Ceilings are metal lath and plaster, suspended immediately below the floor channels. The total depth of floor from ceiling to finished floor is 11 in.

The wall is faced with a 4-in. brick veneer. A 1-in. air space separates brick and steel. Three-inch channels, finished on the interior with metal lath and plaster, comprise the frame, giving a wall thickness of 9 in. The space between the brick veneer and the metal lath is filled with rock wool insulation. Hard-burned common brick are used to face the house. The front entrance is flanked on either side by sandstone, which is also used in the chimney.

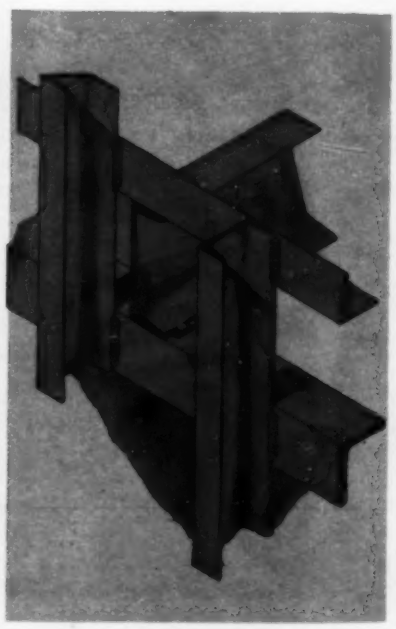
A total of 15 tons of steel was used in construction of this residence. It was divided as follows: 46 per cent for the wall panels, 45.7 per cent for floors and 8.3 per cent for lintels, brick fasteners, etc.

C. Merrill Barber, Cleveland, was the structural engineer. The house was erected by George Lathrop & Son, Toledo, Ohio, and all welding, both shop and field, was done by the Art Iron & Wire Works of Toledo. The steel was furnished by the Carnegie Steel Co. In regard to the simplicity of erecting the framework of this house, Walter Lathrop, speaking for the contractors, stated that the only equipment used was an A-frame and a Lincoln welding machine.



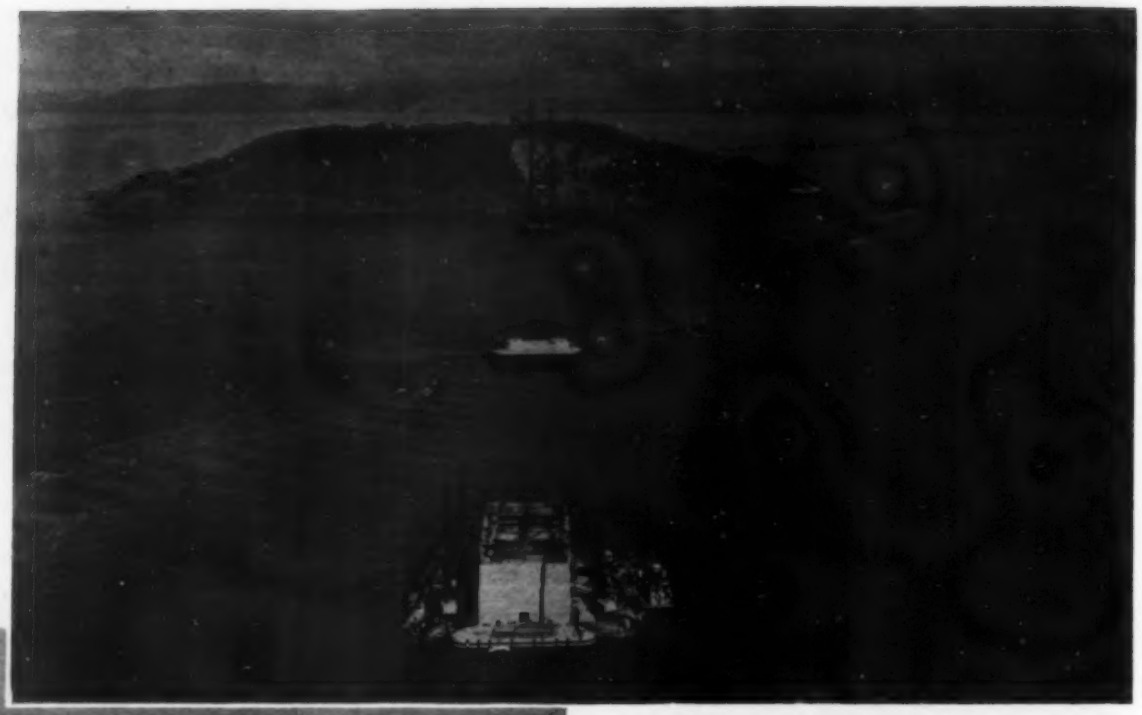
TYPICAL WALL SECTION, showing metal clip fastening brick veneer to frame.

SECTION through wall at first floor level, showing floor construction, welding and sill detail.



DETAIL of steel framing at second floor level showing welding.

# PIERS Completed *for Trans-Bay Bridge*



WEST BAY CROSSING, showing concrete center anchorage (in foreground), completed pier No. 5 and tower No. 6 in front of Yerba Buena Island, beyond which, (in right background) route of East Bay crossing is indicated.

DOUBLE-DECK APPROACH spans *(left)* being extended westward from bridge head of East Bay crossing.

THREE TOWERS of West Bay crossing completed, with hammerhead derricks in place at top of tower in foreground.

UNIFORMLY GOOD progress has been made in building the San Francisco - Oakland Bay bridge which now rounds out 1½ years of construction with foundations practically complete and steel erection well started. It is contemplated that the stringing of wire in the suspension cables on the west crossing will begin about Feb. 1, 1935. The probable date for opening the bridge to traffic now appears to be about Oct. 1, 1935.

In the West Bay crossing all the piers are above water level and all but the center anchorage have been completed up to the structural steel level. Steel tower erection in the West Bay has been proceeding rapidly, the hammerhead derricks, developed by the Columbia Steel Co. for this job, according to C. E. Andrew, bridge engineer, are "superior to the creeper type of derricks ordinarily used for erection of this sort and the towers are going up so fast the shops are barely able to keep up with the erection crews." Each of the four West Bay towers calls for about 5,000 tons of steel; three towers are now complete and the fourth is scheduled for completion before the end of this year. Total amount expended on the work to date is about $19,000,000.

The West Bay crossing is in reality two halves, each a complete suspension bridge, separated by the central anchorage pier. The cable spinning, which is estimated to require about a year, will be done first in the west half of the center anchorage and later on the eastern half. While spinning on the eastern half is under way, suspenders will be attached to the cables and stiffener trusses will be raised to place on the west half. In order to maintain uniform loading, truss sections will be placed first at the center of the west center span and at the anchorage ends of the side spans. From these points erection will proceed simultaneously toward the towers. The same sequence will be followed later when truss erection is begun east of the central anchorage pier.

HAMMERHEAD DERRICKS erecting steel at top of tower No. 3.

On the East Bay crossing all but two of the piers have been completed and these should be finished this year. Erection of structural steel westward from the east bridge head is well under way; five 290-ft. spans have been erected to date. The cantilever principle is being employed on the East Bay crossing, making use of one falsework bent at the center of each span.

A feature of the east approach is the long earth fill paralleling the Key Route mole. This was constructed by first excavating the soft mud from the site, the depth of excavation varying from 5 to 20 ft., and then pumping in about 1,500,000 cu.yd. of sand by means of an electrically equipped suction dredge delivering through a 24-in. discharge line. The rate of depositing this material at times was in excess of 25,000 cu.yd. per day or more than 1,000 cu. yd. per hour. Removal of the soft mud before the sand was dredged in gave a firm base on which to place the fill and very little settlement has occurred.

# PRECAST CONCRETE PIPE

## *Forms 12-Ft. Diameter Siphon*

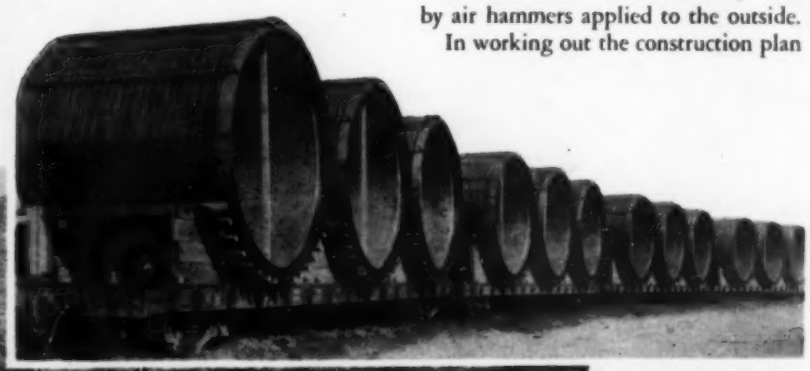
PLACING AND VIBRATING concrete *(above)* in forms for 12-ft. pipe-sections. Vibrators are chained to outside of form and are used also inside forms.

THE AQUEDUCT now being built to bring water 241 mi. from the Colorado River to Los Angeles, Calif., will include 150 inverted siphons whose total length will be about 27 mi. Because of the large cross-section of the aqueduct there was some question as to whether it would be economical to use precast concrete pipe for the siphons. Accordingly, Little Morongo siphon, 723 ft. long with a maximum head of 118 ft. on pipe of 12-ft. diameter, was selected as a job on which to make a test of the success and economy of precast pipe as compared with monolithic construction, which is under way on one or two similar siphons. The methods employed in handling the 40-ton, 12-ft. long precast pipe sections in Little Morongo Canyon are described herewith.

The function of this siphon, which is located about 26 mi. east of Banning, Calif., will be to connect two tunnel portals that overlook and are separated by Little Morongo canyon. For about 400 ft. the bottom of the canyon is at approximately level grade, so the siphon consists of this flat section and two inclined portions extending up the canyon walls. The incline connecting with the tunnel portal on the west has a maximum slope of 45 deg. and the one on the east 37 deg.

In the lower part of this siphon the reinforcing consists of welded steel pipe with cages of circumferential and longitudinal steel bars both inside and outside the steel cylinder. The steel was assembled and welded in Los Angeles, loaded on flat cars, three sections to the car, and shipped to the job. The pipe casting yard was laid out immediately adjacent to the site of the siphon so that heavy sections would have to be moved a minimum distance. The sections were cast on end in steel forms and effective compacting of the concrete around the reinforcing was obtained by extensive use of vibrators inside the forms, aided by air hammers applied to the outside.

In working out the construction plan



REINFORCING STEEL, assembled in cages which consist of steel pipe with bars on the inside and outside, are made up in Los Angeles and loaded on flat cars for shipment to job.

CASTING YARD *(left)* is located at bottom of canyon close to site of siphon. Crawler crane handles steel reinforcement cages and cylindrical steel molds for 12-ft.-diameter concrete pipe sections with 12-in. shell thickness each 12 ft. long and weighing 40 tons.

every possible advantage was sought for the most difficult part of the operation which was admittedly the handling and exact placement of the sections.

Across the bottom of the canyon a trench 20 ft. wide on the bottom with ¼ to 1 slopes and 24 ft. deep was first excavated, with its center line on the prescribed location for the siphon. On the canyon side slopes, where the excavation was mostly in rock, the trench was made of just sufficient depth to permit the specified 3-ft. minimum cover over the top of the pipe. All excavation was done with a dragline operated by a locomotive crane on crawlers. The same machine was used later for lifting and placing the pipe sections.

After the completion of the trench, a track of 4½-ft. gage was laid in its bottom using 60-lb. steel rails supported on steel ties set in concrete ballast which was very carefully placed to the exact grade for the underside of the siphon. Thus when pipe sections were supported on this concrete on the designed alignment they would be exactly in the specified position.

**SECTIONS WERE JACKED** into position after release from gantry by pair of jacks braced against brackets bolted to rails.

**HOISTING** one section up ramp into position for sliding it down trench track.

**TRACK** *(left)* for delivering pipe to top of incline and section of precast pipe already in place in trench, with traveling gantry at extreme end of line.

For delivering pipe sections into the level part of the trench, two ramps were excavated down to the trench bottom at convenient points. From their position in the casting yard nearby, the pipe sections were tipped over on their sides, pulled by a tractor to the nearest ramp, and then were rolled down into the trench in the bight of a cable. From the ramp they rolled directly on to a car on the 4½-ft. track and the car was pulled along the trench to within a foot of the last pipe-section laid. At this point the section was lifted from the car by a gantry crane spanning the pipe and after the car had been removed, the pipe-section was lowered directly on to the rails. Two 25-ton jacks working against brackets clamped to the rails, slid the pipe longitudinally into place against the adjacent section.

After the level portion of the siphon had been laid, a vertical angle section, consisting of a steel cylinder bend with joint rings attached, together with the outside reinforcing cages, was set at the toe of each of the slopes. A section of straight pipe was then placed by the crane, immediately above the bend and an exterior coating of concrete around the bend was cast in place. Meantime tramways were built on each side of the canyon from the bottom up the slope to a point near the upper end of the inclined portion of the trench. When the vertical-angle sections of the pipe had been cured properly, the next section to go in the side slope was hoisted to the top of the tramway with a steam hoist, transferred from the tram car to the trench track by the locomotive crane, and then allowed to slide down the track to within a foot of the last section laid.

For convenience in handling the sections on the tramway, and in lowering them down the inclined track, a sling was designed to attach the hoisting line to the section. This sling had to be removed before the pipe could be entered and this was done by holding the section in place with blocks while the hoist cable was transferred from the sling to a bridle fastened to the pipe with clevises. The clevise pins worked in 2-in. pipe cast in the bell, at the ends of the horizontal diameter and welded to the joint ring about 5 in. from the end of the pipe. After the section was in place, the hole in the steel joint ring was closed by welding and the pipe was filled with cement mortar.

On a pipe of so large a diameter, it was thought desirable to give particular attention to the joints—a vital factor in any type of pressure pipe construction. On this job joints consisted of specially shaped steel bands welded on to the steel cylinder for the higher heads and on to the longitudinal steel for the low-

A SECTION SLIDES DOWN rails *(above)* to its place in siphon. Crane at top transferred it from ramp to pipe trench.

45-DEG. ANGLE *(left)* on west slope after completion; bend is covered by monolithic concrete.

MAIN PIPE *(below)* in level portion of siphon, with gantry which lifted section from car and lowered it into place on concrete ballasted track.

4-lb. calking hammer on the joint ring.

After the calking was finished, the narrow space on the outside between the pipe-sections was poured full of cement grout; the inside joint space was filled with mortar applied with a cement gun and the mortar immediately troweled off smooth and flush with the inside of the pipe. The 2-in. inside lining of all bends also was placed with the cement gun and troweled off smooth while the mortar was still fresh, using a circular template to insure a true circular cross-section throughout the bend.

There were four vertical and two horizontal curves on the line with angles varying from 8 deg. to 45 deg. The radius of all curves on center line was two and a half diameters or 30 ft.

The completed siphon was tested by welding a diaphragm over each end and filling the line with water under the prescribed pressure. Specifications limited leakage to 15,000 gal. per mile of pipe per 24 hours or 104 gal. per inch of diameter. The actual leakage in the siphon in a 24-hr. test (after the pipe had stood full of water for 30 days to take care of absorption) was only 92 gal. per inch in diameter.

The joints used were the Lock Joint lead and steel type and were furnished to the contractors by the district under an agreement whereby the district stipulates it will furnish this type of joint wherever precast reinforced concrete pipe are used on aqueduct siphons.

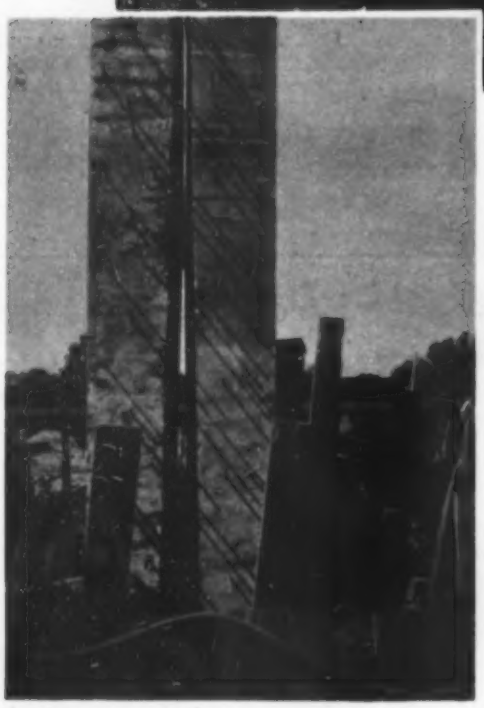
The contractors on the job were the United Concrete Pipe Corp. and the American Concrete & Steel Pipe Co. H. H. Jenkins, vice-president of the latter company, is in charge, with C. A. Meade as superintendent. F. E. Weymouth is general manager and chief engineer of the Metropolitan Water District of Southern California. J. B. Bond is construction engineer and R. B. Diemer is division engineer of Division 4, in which Little Morongo siphon is located.

er heads. Before these steel joint-rings were assembled with the steel reinforcement, they were stretched by a hydraulic press past their elastic limit to form them into perfect circles. Thus when the pipes were laid, these joint rings telescoped and provided an exact and uniform calking space between them. Into this space a special shaped lead gasket was driven from the inside of the pipe after each section had been set accurately in place.

The concrete cradle supporting the pipe over a 90-deg. arc. was poured in lengths of about 100 ft., pouring being carried on simultaneously on either side of the pipe. The cradle was cured for ten days, after which the trench was backfilled to grade. The second calking of the lead gasket followed the backfilling, and was done by two men with a heavy calking tool and an 8-lb. sledge. The final calking was done a few days later by one man using a

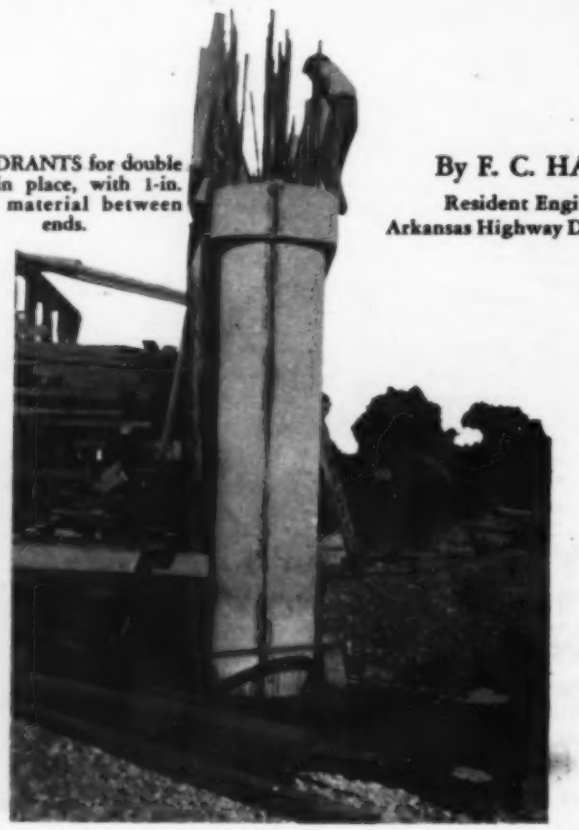
TEN 38-FT. SPANS form rigid-frame concrete bridge crossing Crooked Creek.

# *Rigid-Frame Concrete Bridge Has* DOUBLE ELASTIC PIERS



DOUBLE ELASTIC PIER consists of independent sections spaced 1 ft. apart at bottom and 1 in. at top.

OAK STRIPS are placed against first section of double pier to act as inside forms.



QUADRANTS for double pier in place, with 1-in. joint material between ends.

By F. C. HART
Resident Engineer
Arkansas Highway Department

AN UNUSUAL TYPE of reinforced concrete bridge crosses Crooked Creek at Harrison, Ark. The structure is on state highway No. 65 and was built for the State Highway Commission by the Interstate Construction Co., of Ft. Smith, Ark. Work was started July 21, 1930, and the new bridge was opened to traffic on Christmas Day of the same year. The work was completed in 133 working days.

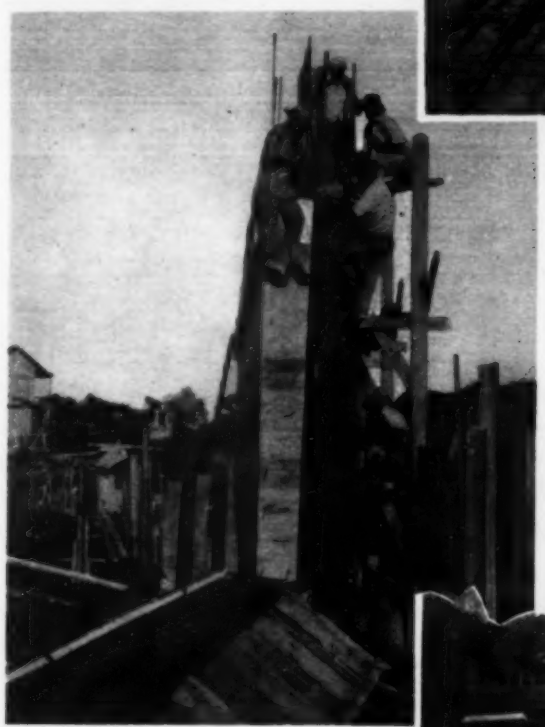
*Design*—The location was such that a maximum waterway had to be obtained with minimum deck elevation. To accomplish this a rigid-frame, reinforced concrete slab bridge was designed, each span made to simulate a flat arch. The slab is 17½ in. thick at the center and the clear distance between piers is 38 ft. The rise for the center section of 36 ft. 6 in. is 1 ft. The slab is self-supporting, having no girders. The bridge consists of 10 spans and has an over-all length of 401 ft. The roadway is 30 ft. wide, with a 5-ft. sidewalk on each side. The weight of each span is indicated by fact that each slab contains 117 cu.yd. of 1:2:3 concrete and 21,200 lb. of reinforcing steel.

*Foundation Difficulties*—The bridge is so designed that no settlement can be permitted at the footings and therein lay the greatest problem in construction. Solid rock was not found, as anticipated. At an average depth of 15 ft. below the streambed we found an underground stream of water, independent of the creek above and running at right angles to it, so that it was encountered at every footing. This water flowed through a deep crevice in the limestone strata and, as depth of excavation was increased, boiled out with artesian force. The stream was not large, being handled by a 6-in. centrifugal pump, but the depth and variation of the crevice convinced us that it would be impractical, if not impossible, to reach its

bottom. We excavated to a depth where the crevice narrowed to from 3 ft. at one of the piers to 15 ft. at abutment No. 1 and bridged the crevice by increasing the thickness of the footing and designing it as a beam. The greatest depth of footing reached was 26 ft. below low water line.

All excavation was done with a ½-cu.yd. clamshell and Insley excavator; dump buckets were used for the deepest holes. This machine did our excavation, drove our falsework piling with a 1,500-lb. hammer, removed forms for the piers and set them in place, hoisted all concrete for piers and slabs from two 1½-bag mixers which were set at convenient points for hoisting and, with a shovel attachment, loaded earth for the approach fills into trucks.

REINFORCING STEEL and forms preparatory to pouring first triple span between piers No. 2 and 5.



REMOVING *(left)* first of oak wedges after pouring second section of pier.

FALSEWORK PILING *(right)* being driven for first span of Crooked Creek Bridge.

CONCRETE *(below)* from two 11-cu.ft. mixers is delivered to forms by crane and bucket.

*Piers*—The main feature of the bridge is the method used to take care of temperature changes. This is done by use of double elastic piers and elastic abutments. The breast-wall of the abutments is independent of the wing-walls and an integral part of the slab. A construction joint is placed at the springing line, but the reinforcing steel continues into the slab in such a way that contraction and expansion of the slab will be taken care of by movement in the breast-wall section of the abutment. For the purpose of taking care of temperature action the bridge is divided into four units consisting of two spans, three spans, three spans and two spans, respectively. At the end of each unit, except at the abutments, a double elastic pier is placed. No construction joints were allowed except at the ends of these units.

The double elastic pier consists of two independent sections 1 ft. apart at the bottom and 1 in. apart at the top, set on a single footing. The outer walls of the double pier are plumb and the inner walls batter so that each section is 18 in. wide at the top and 12 in. wide at the bottom. The opening between these sections is closed at the end by a semicircle of reinforced concrete separated into quarters by a vertical piece of joint material 1 in. thick. This maintains the two sections independent of each other and gives the whole the outward appearance of a single pier. From the top of the pier to the deck the two units are separated by 1 in. of premolded joint material.

*Forms*—The method used in placing a form between these two sections and removing it after pouring is illustrated. One of the sections was formed and poured and after the forms were removed a collapsible form for the inside of the second section was set up against the first. This was run up to within 5 ft. of the top, where the space between the sections became too narrow for this type of form. On top of this was set wedge-shaped strips of seasoned oak the size of the opening required. Reinforcing steel was then placed and the outside form set up. The whole was held together by washers and bolts run through the entire pier. The bolts were set in pipes which held the washers in place and acted as spacers; the imprints of the washers were filled with concrete when the forms were removed. The bolts slipped out through the pipes which were left in the concrete. As soon as the lower section of the inside form was taken out, the oak wedges could be removed by striking them on top and letting them fall between the two sections where they could be removed for use again.

STEEL BARS are placed to reinforce concrete in second section of double pier.

The semicircular ends of the piers, which were divided into quadrants by the vertical strip of joint material, were from 18 to 21 ft. high from top of footing to top of cap. The radius was 18 in. and each quadrant was reinforced by four ½-in. round bars held in place by hoops at 18-in. centers. Because of an 8-in. copper water stop cutting the 1-in. joint material vertically we had no means of holding the entire 18 to 21 ft. of it in place. On account of this, 4-ft. sections were set up and poured with buckets, the concrete in each quadrant being held at the same level as the form was filled to equalize the pressure on each side of the joint and water stop. All reinforcing steel was placed before starting the forms. Carpenters worked at each end placing the forms and the copper water stop and pouring alternate sections as they were set up. Thus pouring was continuous. The building of the forms and the pouring was timed so that the concrete at either end was not permitted to set while the next section of the form was being placed.

# "Performance sold us!"

## Said A. J. HENDRICKSON,

president of Hendrickson Bros., Inc., Valley Stream, N. Y. "We have used practically all makes of tractors, but found that the sturdy construction of A-C tractors performed more than satisfactorily at high speeds. Their ability to 'take it' under difficult conditions at fast speed means more dirt at less cost." Shown on this page are views of the Hendrickson Bros.' contract on Long Island . . . involving 94,000 yards — mostly sand — in 4¼ miles of road between Moriches and Riverhead. A job that "kept going" during unfavorable wet weather — it could not have been handled without tractors and track wagons. A-C equipment on the job — three "L's", one "K", and A-C 8-yard wagons.

What about your own job? Is your equipment unsuited for adverse conditions — losing yardage on bad days, or in tough soil? You, too, can boost those yardages with A-C equipment. It will pay you to be familiar with the "More Value" features of A-C wheel and track-type tractors, power and hand controlled blade graders, elevating graders, Speed Patrol graders, track wagons, wagon tracks, and power units.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

### WAGON TRACKS

If truss type tracks were best, wouldn't they be used on tractors, too? The modern A-C 15-20 ton tracks are built on the same principle as tractor tracks. Eight rollers support the load — easy running when new or old . . . proven longer performance.

### 25 YARDS

drickson Bros. like big s. These 8-yard A-C ons are built up with boards to carry 12 yards, r level. Be sure to get e — haul with track ons.

### SPEED

Seconds gained per trip mean extra yardage per day. With 76 H.P. and a 6½-mile speed, the "L" and "L-O" haul big loads and get back in a hurry.

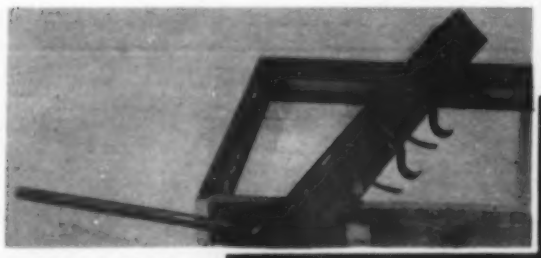
### A NECESSITY

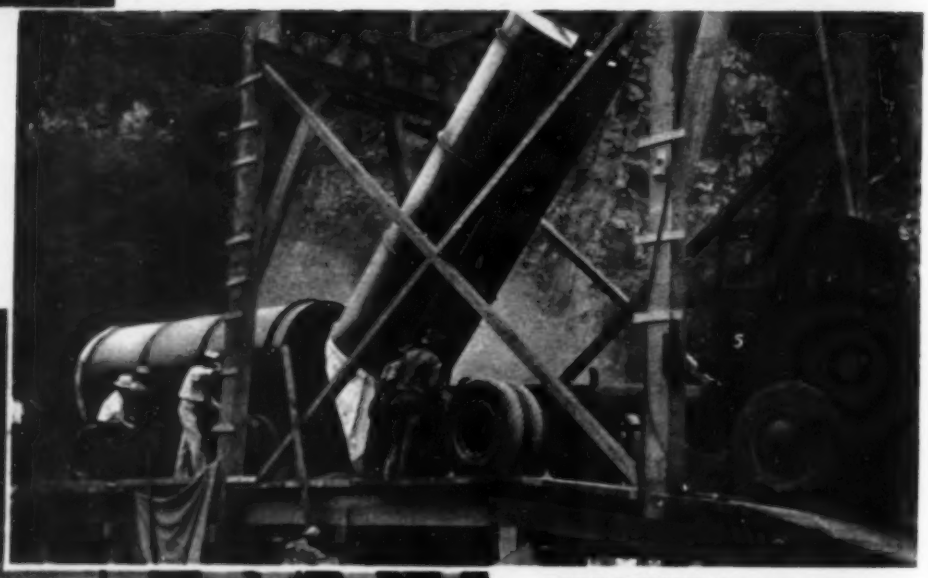
On the go every minute of the day — this model "K" — using its 48 H.P. to keep hauling roads level and the dump spread. There is need for a "K" or "K-O" on nearly every job.

# *Getting Down to* DETAILS

[ Close-up Shots of Job Methods and Equipment ]

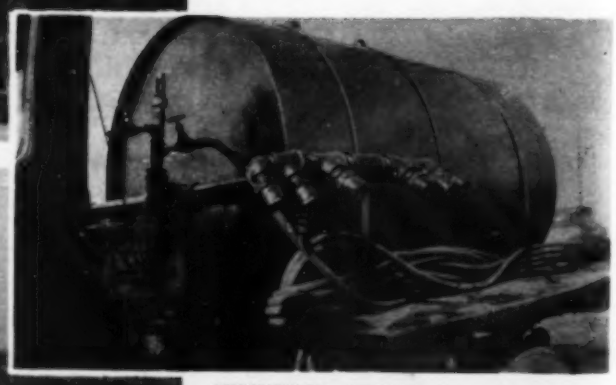
PORTABLE STEEL-PIPE FRAME carries 2,300-volt electric power cable over runway used by motor trucks handling excavation for power-house foundation at Wheeler dam, Tennessee Valley Authority project. Frames are easily shifted by hand to avoid interference between truck operations and cable leads to 3-yd. electric power shovels.





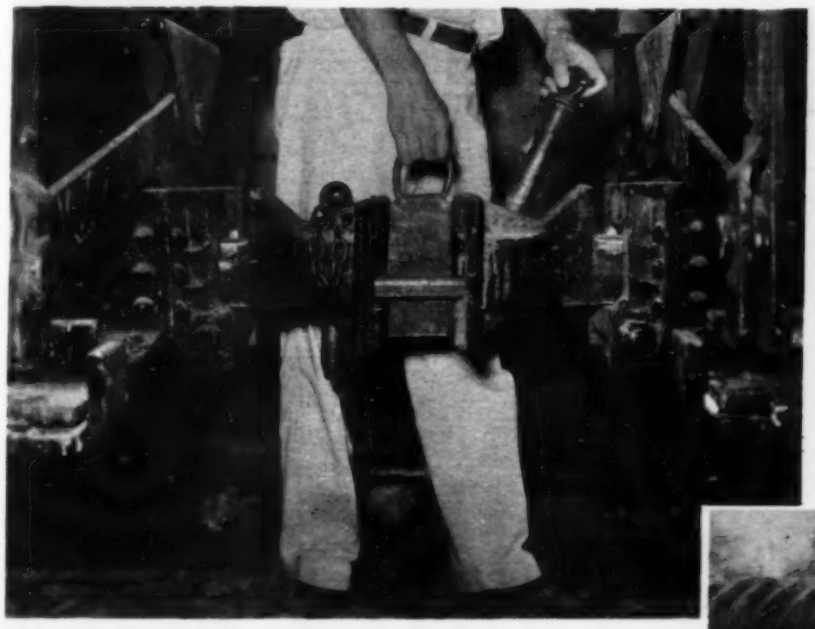
MODEL OF HANGER *(above)* designed by engineers of New Jersey State Highway Department simplifies task of supporting reinforcing steel while full depth of concrete pavement is placed. Device consists of steel angle with hooks for supporting reinforcement and lever handle welded on one end. Angle is stable while resting on two edges on top of road forms. After concrete has been placed, hooks are disengaged quickly by using lever handle to tilt angle on one edge. OLD TYPE OF HANGER *(right)* made up of steel channel with hooks attached, is cumbersome and difficult to remove after concrete has been dumped.

BULK CEMENT for mass concrete in Morris (formerly named Pine Canyon) dam, Pasadena, (Calif.) water supply project, is delivered in 21-ton loads by special tank truck and trailer units which are unloaded by end-dumping into hopper from which cement is pumped into 4,000-bbl. steel storage silo.



SPRINKLER TRUCK for pavement construction has six nozzles *(above)* at each side of 550-gal. tank operated by Jaeger self-priming centrifugal pump and adjusted to throw uniform spray *(left)* across desired width (in this case, 12 ft.). Truck wets subgrade and burlap on concrete paving project of Johnson, Drake, & Piper, Inc., of Freeport, Long, Island, N. Y. D. E. Burner & Fuel Corp., Rockville Center, L. I., N. Y., owns and operates truck.

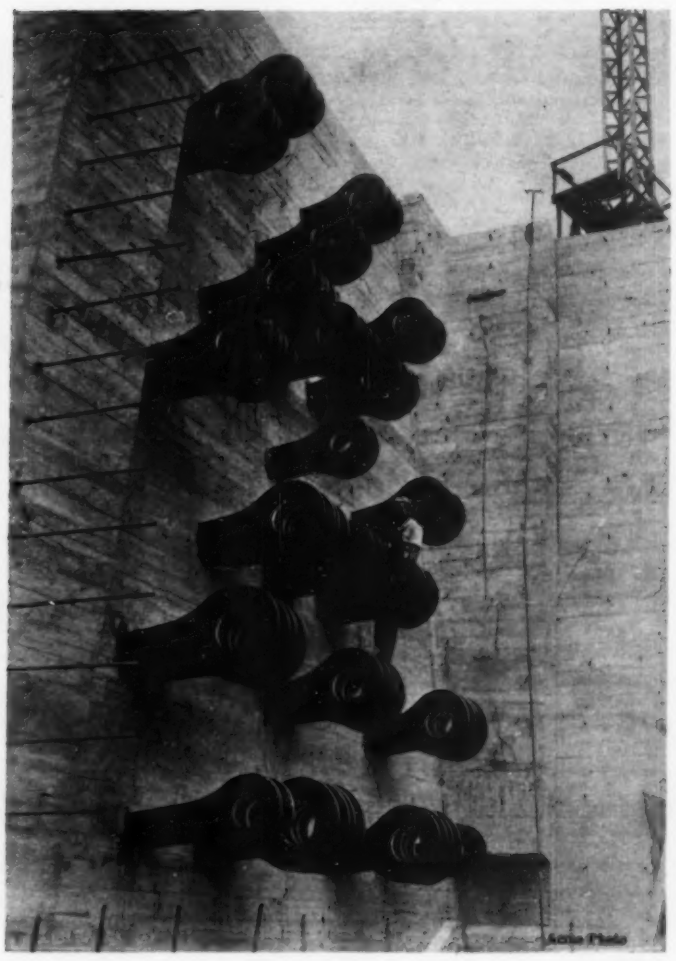
SAFETY CAR-COUPLER *(below)* prevents injury to workmen in tunnel construction for Colorado River aqueduct in California. With modified bar type of coupler illustrated, safety handle places man's hand out of danger zone and plate prevents coupler heads coming together. Device is effective in reducing haulage accidents, according to T. W. Osgood, safety engineer for the Metropolitan Water District of Southern California.



THREE-COLORED SAFETY LANES for pedestrians are painted on downtown streets of St. Paul, Minn., to reduce traffic accidents. Visibility of lanes, 8 ft. wide, is made prominent by stripes of orange, white and black.

SEWER ON STILTS *(right)*. City of Conneaut, Ohio, builds 420-ft. trunk line outlet of 15-in. Armco paved-invert corrugated pipe across ravine on steel A-frame trestle. Bents of two 8-in. channel irons, placed back to back to form legs, are spaced 20-ft. apart and at deepest point of ravine are 32 ft. high. Angles and bolts at bottom anchor A-frames to concrete footings 24-in. square and 30 in. deep. PIPE CONNECTION *(inset)* is made by four rods drawn up tight by special nuts around connecting band or collar.

EYEBAR ANCHORAGE *(below)* for San Francisco - Oakland Bay Bridge in California. In massive block of concrete 74 steel eyebars are embedded to hold south cable of suspension span.

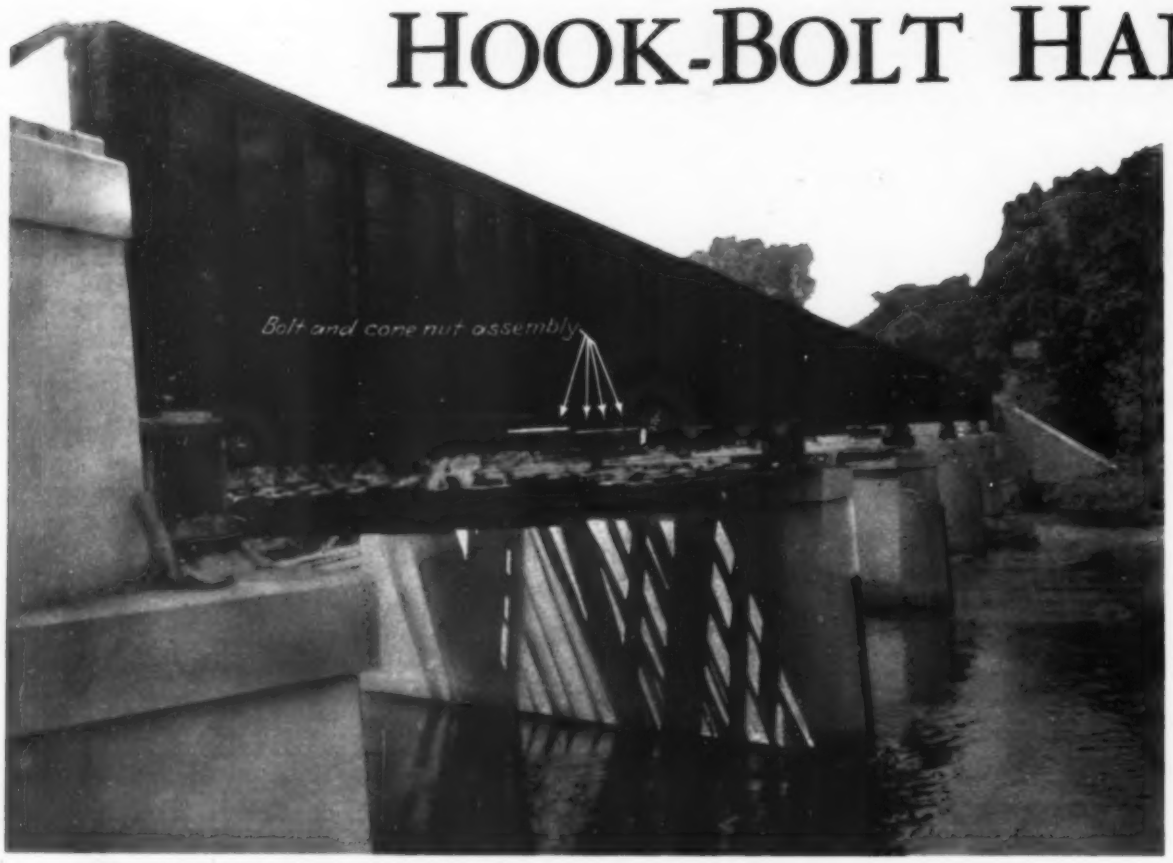


BIG BUCKET *(left)*. This dragline excavator, taller than men who operate it, has a capacity of 5 cu.yd., and is used by Six Companies Inc. at Boulder Dam to dig Arizona gravel deposit.

# HOOK-BOLT HANGERS

## *Support Steel-Incasement and Deck Forms*

By L. H. BEEBE,
*District Engineer,*
*Connecticut State Highway Dept.*

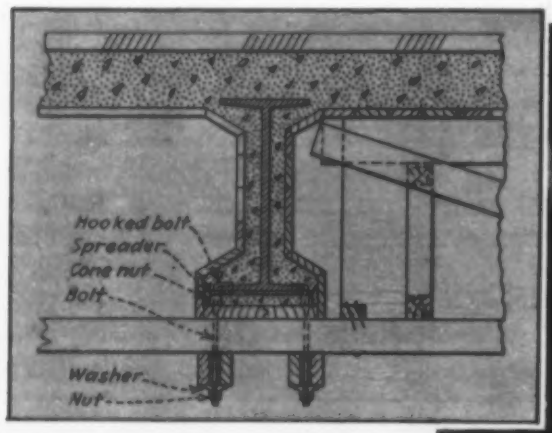


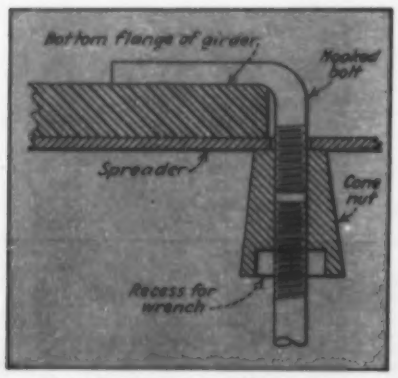

**STEEL-INCASEMENT FORMS and slab forms of Quinebaug River bridge, Jewett City, Conn., are supported from lower flanges of girders by hangers made up of hook bolts, cone nuts, and straight bolts.**

A HOOK-BOLT and cone-nut assembly for hanging concrete forms from the lower flanges of horizontal structural steel members simplified the erection and stripping of beam-incasement and slab forms on the Quinebaug River bridge, at Jewett City, Conn., built by the Connecticut State Highway Department. The assembly consisted essentially of a pair of short bolts threaded at one end to screw into cone nuts and bent at the other end to hook over the bottom flange of a steel girder. These bolts were rigidly spaced by a steel spreader bar, accurately punched to hold the bolts in close contact with the flanges. Straight bolts, threaded at both ends and screwed into the cone nuts, supported the forms, as illustrated by the accompanying drawing.

After the hook bolts and spreader had been put in place against the lower flange of a girder, the cone nuts were run up on the threads of the hook bolts tight against the spreader. The cone nuts served to jam the bolt against turning and also acted as a spacer between the girder and the beam bottom form. Bolts run up into the bottom of the cone nuts supported two double lines of timber beams, as indicated by the drawing. Wooden joists running transversely across these timber beams supported the beam bottom form, the beam side form and the concrete slab forms for the deck above.

No falsework was required with this method of form support, as a temporary swinging staging was hung between the beams until the joists were in place and the bolt and cone assembly tightened. The entire arrangement of hangers and joists gave rigid support to all forms and interfered in no way with wrapping the beams with wire mesh or erecting the forms.



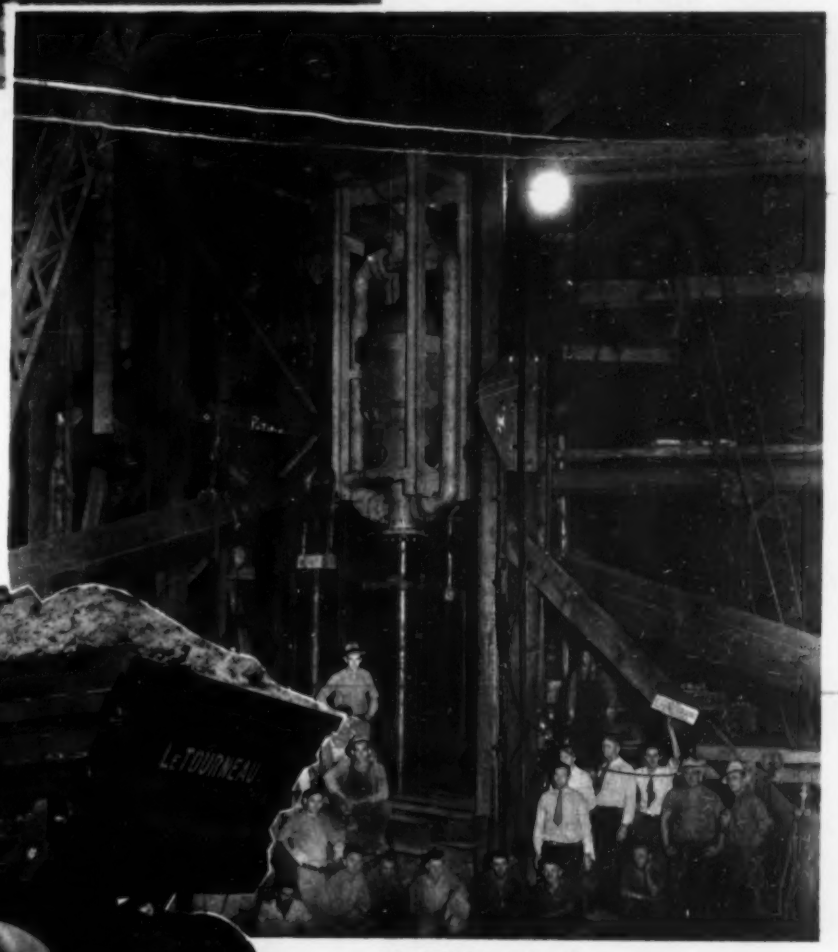




**HOOK BOLT AND CONE NUT, with steel-plate spreader to space hook bolts accurately, are essential parts of hanger which supports steel-incasement and slab forms *(above)*.**

**WOOD STRINGERS in pairs are hung by bolts from lower flanges of girders. Transverse wood joists rest on timber stringers.**

DREDGING BY SPOONFULS. How hand labor methods are employed to remove material from bed of Grand Union Canal in England.

BIG PUMP *(below)* for unwatering Potrero shaft of San Jacinto tunnel on Colorado River Aqueduct in California is rated at 750 hp. and has capacity of 2,600 gal. per min. against an 800-ft. head. Peerless unit, supplementing two 1,200 gal. per minute pumps, is electrically driven by tap line from sub-station of construction power system installed by Metropolitan Water District of Southern California. On first day large pump was operated water in shaft of Wenzel & Henoch's contract was lowered 30 ft.



# JOB ODDITIES

*A Monthly Page of*
*Unusual Features of Construction*

TUNNEL FOR GOLFERS ONLY. Where the 40-ft.-wide concrete paved highway being built between Cambridge and Concord, Mass., crosses the course of the Minute Man Golf Club in Lexington, the Massachusetts Department of Public Works has provided a rectangular reinforced concrete tunnel undercrossing *(below)* to enable golfers to reach the fifth tee from the fourth green without the hazard of dodging high-speed motor traffic on a section of the main route between Boston and Albany.

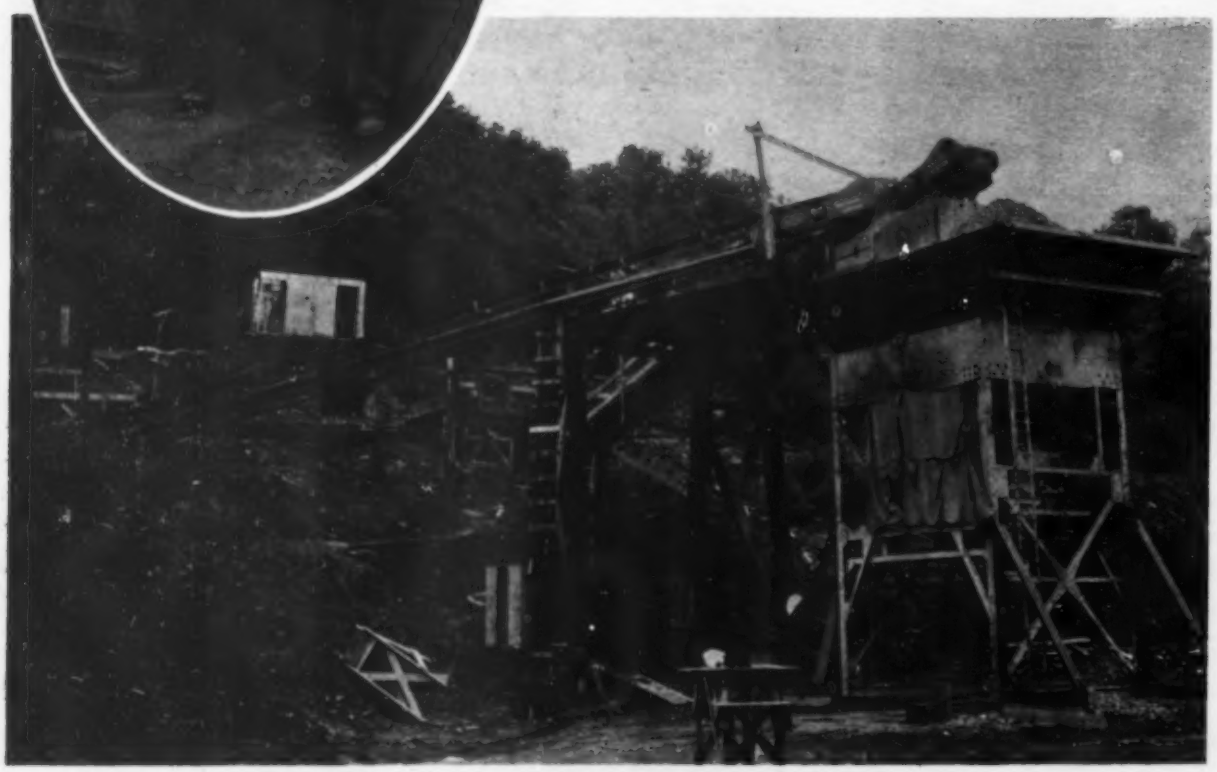
WHEELS APLENTY. Sixteen 20x46x10-in. pneumatic tires of the "doughnut" type, carrying air at 40 lb. per square inch, insure light bearing pressure for new type of huge Le Tourneau tractor-hauled buggy, having a load capacity of 30 cu.yd., and destined for use in moving earth on the Bonneville power and navigation project on the Columbia River above Portland, Ore.

CRACKING DOWN on cottage at Virginia Beach, Va. Universal truck crane *(below)* interrupts normal operation on construction work to rush to scene of airplane accident and salvage wreckage.

CONCRETE-PAVING PLANT built around dual-drum mixer and designed for high yield lays 12 mi. of 30-ft. concrete roadway in 937 paving hours, averaging 59½ batches per hour.

# High-Production EQUIPMENT *Speeds 12-Mile Paving Project*

J. WILLIAMS (left, below) superintendent of concrete paving for York Engineering & Construction Co., and A. J. KUHN, project engineer for Pennsylvania Department of Highways.



AGGREGATE-BATCHING SET-UP at materials-handling plant utilizes two belt conveyors delivering sand and stone simultaneously from pits under hillside railroad spur to bins above weighing batchers.

BY PURCHASING the most modern and efficient equipment available and managing it skillfully to obtain maximum productiveness, the York Engineering & Construction Co., of York, Pa., established several outstanding records in earth moving and concrete paving for the Pennsylvania State Department of Highways on a 12-mi. section of state route 8, south of Butler, awarded to this contractor at a total bid price of $781,045. Six power shovels and a fleet of 41 trucks removed excavation (aggregating 466,000 cu.yd.) at an average rate of more than 6,000 cu. yd. per day. Three-lane concrete pavement was placed and finished to its full width of 30 ft. at a rate of nearly 900 lin.ft. per day. To maintain this paving speed, a Ransome dual-drum paving mixer, serviced by an efficient batching plant and truck fleet, produced 59½ batches per hour for each hour that the mixer drum was revolving and 52 batches per hour for each hour that a construction crew was employed on the work.

*Location and Design* — Work completed this year on the 12-mi. contract

of the York Engineering & Construction Co. and on an adjacent 1.62-mi. contract of the Holmes Construction Co., of Wooster, Ohio, forms the final link in a relocated and improved route 8 between the borough of Etna, on the north bank of the Allegheny river, and the city of Butler. An approximately equal length of highway in Allegheny County was relocated and widened within the last few years. Route 8, long known as the Butler Plank road because of its former construction as a timber roadway, is the principal traffic artery between the cities of Pittsburgh and Butler. Renamed the William Flinn highway, it was formally dedicated and opened to traffic by Governor Pinchot on Oct. 27.

In the 12-mi. length of the contract, extending from the Allegheny county line to Butcher Run, the new alignment includes 13 curves, only one of which is as sharp as 4 deg. The flattest curve, of 28-min. curvature, is 8,700 ft. long. As the topography is rolling and uneven, the road rises and falls in a series of grades, none of which reaches 9 per cent, although in five places the grades approach this percentage.

Except in the village of Coopers-town, where the width of the right-of-way is restricted to 50 ft., the improved highway takes a right-of-way 70 ft. wide. The concrete slab itself has a 30-ft. width, a 2-in. parabolic crown, and a 10-8-10-in. cross-section with a sectional area of 21.1107 sq.ft. Thickness of the slab tapers from 10 in. at the edge to 8 in. at a distance 10 ft. from the edge, where a longitudinal joint occurs. The central 10-ft. section has a uniform 8-in. thickness. Bar mat reinforcement was installed in the concrete 2 in. below the finished surface. The total area of pavement was 210,000 sq.yd.

Transverse expansion joints of ½-in. premolded asphalt were placed a maximum distance of 152 ft. apart. It was required also that expansion joints be incorporated in the pavement at both points of tangency of each vertical curve and at the end of each day's run. Joints could not be located over pipes or drainage structures.

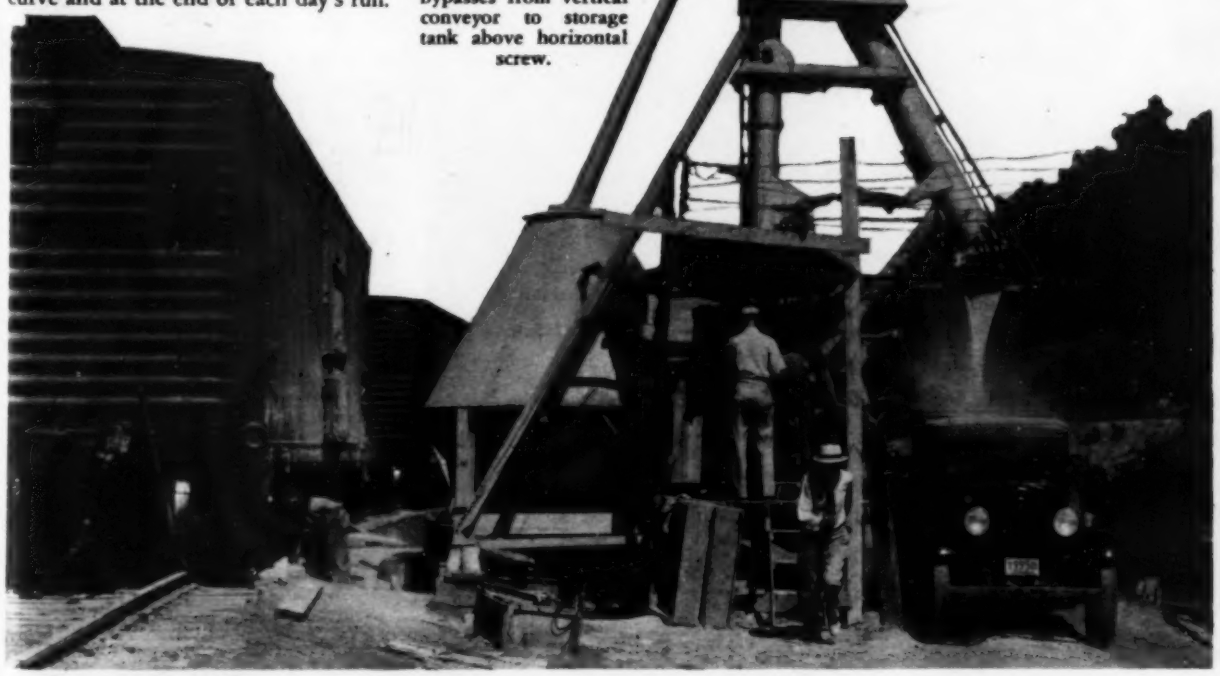
**DUAL-DRUM PAVER mixes two 1-yd. batches simultaneously in double compartments of long cylindrical drum. Mixing time in each compartment is regulated by batchmeter and bell.**

**A. H. DIEHL(left), plant superintendent, A. J. KUHN, project engineer, and R. W. SMITH, member of contracting firm.**

Two longitudinal cleft-type (weakened-plane) contraction joints were installed in the slab to divide the pavement into three 10-ft. lanes. These joints were filled with premolded asphalt strips ¼ in. thick by 2¼ in. deep. A 6-in. break in the mat reinforcement occurs at the location of each longitudinal joint, but the 10-ft. lanes are tied together by ⅝-in. dowel rods 4 ft. long spaced at intervals of 5 ft.

*Rough Grading*—About 5 per cent rock was present in the 466,000 yd. of earth excavation. Practically all excavated material was utilized in fills, and the cuts and fills were so balanced that the average haul was only about 1,500 ft. Six reconditioned 1¼-yd. gasoline shovels, purchased directly from the manufacturer for this work, handled the earth excavation and removed the old pavement, devoid of reinforcement, wherever it was encountered. A fleet of 30 new V-8 1½-ton trucks and 11 four-cylinder 3½-ton trucks hauled the excavated material from the cuts into the fills. The larger trucks took care of all rock and broken concrete. Cuts ranged in depth up to a maximum of 45 ft. on the high side. The heaviest cut required the removal of about 40,000 yd. in a length of 1,000 ft. On an average day, each of the shovels excavated from 1,000 to 1,400 yd., and the grand average for the six units during the entire period in which they all were operating was more than 6,000 yd. per day.

**BULK-CEMENT PLANT transfers material by two electrically driven screws from track hopper to inclined weight-batching pipe, which discharges into steel container on truck. Excess cement bypasses from vertical conveyor to storage tank above horizontal screw.**



Fills were built up in compacted layers. In the heavy fills, specifications called for 4-in. layers compacted under rollers. In the shallow fills, the contractor was permitted to place 8-in. layers. The material consisted of shale, loam, clay, and rock. These soils compacted readily under the roller to form solid fills. The highest fill on the project, requiring 28,000 yd. of earth, measures 50 ft. in height from the toe of the slope on the low side. This fill forms one approach to a bridge crossing Thorn Creek and the Bessemer & Lake Erie railroad tracks. The bridge was built by the railroad company. Concrete for ten other structures, including five barrel arches, was delivered from Butler by truck mixers.

*Concrete Paving Procedure* — As is customary in Pennsylvania, the road was closed to traffic to permit construction of the pavement to the full 30-ft.

width. Only one economical location for the batching plant was available in the length of the contract. This site was at McBride, where the Bessemer & Lake Erie double-track line crosses the old highway. Two short spurs already were in existence at this point. By extending one of these spurs and by building in cooperation with the railroad a new siding having a storage of twenty large hopper cars, the contractor utilized the steep hillside location of the plant to facilitate transfer of materials.

An accompanying drawing indicates the layout of the batching plant. Cars of aggregates were stored on the upper track and were dropped down as required to unload into track pits from which the materials were delivered to overhead bins on a lower level by belt conveyors. By an arrangement with the shipper, alternate cars of aggregate were loaded respectively with 60 tons of sand and 90 tons of crushed rock, corresponding with the ratio in which the two materials were used by the batching plant.

Bulk cement was shipped to the plant in special hopper-bottom box cars. At the plant, the cement was unloaded, stored, weighed and placed in steel cement compartments on the batch trucks by Blaw-Knox apparatus designed and manufactured for this purpose.

The site of the plant was about 3 mi. from the north end of the contract and about 9 mi. from the south end. It was situated on the old road about ½ mi. east of the new location and about 1 mi. north of the nearest junction with the old highway. In order to eliminate at an early date a 26-mi. detour around the project, adding 10 mi. to the distance between Butler and Bakerstown, in Allegheny County, the contractor started paving operations at the south end of the project and proceeded north about 9 mi. to the vicinity of the batching plant. This section, connecting with the old route into Butler, was opened to traffic about 6 weeks in advance of the completion of the contract. The remainder of the contract was paved from Butler south to the junction.

Concrete ingredients were proportioned by weight in an amount corresponding to a volume ratio of 1:2:3½. Each batch contained 6 cu.ft. of cement and gave a theoretical yield of 26.39 cu. ft. of concrete. The fleet of 30 eight-cylinder trucks previously used on grading was changed over for batch hauling, each truck being equipped to carry two batches, a total weight of about 7,500 lbs. When hauling 9½ mi. to the south end of the job, the contractor operated the full fleet. By the time the haul had decreased to 3 mi. the number of hauling units was reduced to 15.

*Fine Grading*—For the first 7 weeks of pavement construction, the contractor built subgrade at night, using two Universal gasoline - powered lighting plants with a total capacity of 6,500 watts to illuminate the work. This arrangement kept the fine grading crew off the project during the day and left the subgrade clear for truck hauling. Because showers often prevented night work, however, and because rain sometimes washed out the results of a night's labor, the contractor changed to day operation for the fine-grading crew, building one-half the subgrade at a time ahead of the mixer and leaving the other half clear for the trucks. Rough grade was shaped and rolled ½-in. high prior to subgrade operations to facilitate batch hauling by trucks, to take care of drainage after rains, and to reduce fine grading just ahead of the mixer.

Steel forms 10 in. high, with an 8-in. base, were set about one day's run (800 to 900 ft.) in advance of the mixer. The job was equipped with 4,500 lin. ft. of steel forms, sufficient for the construction of 2,250 ft. of pavement.

*Dual-Drum Paver*—As described in former issues of Construction Methods, Jan. 1934, pp. 34-36, and Sept. 1934, pp. 26-30, the dual-drum paver has a long cylindrical steel drum divided into two compartments with a rated capacity of 1 cu.yd. each plus a 10-per cent overload on a maximum grade of 6 per cent. The machine is equipped with a powerful 6-cylinder gasoline motor which rotates the dual drum at 16 to 20 r.p.m. A transfer chute passes batches from the first compartment into the second. The weight of the unit is so widely distributed by long crawler treads that the unit ground pressure is less than that under an ordinary single-drum mixer.

Pennsylvania specifications for a single-drum paving mixer require a 1¼-min. mixing period after all materials are in the drum. For the dual-drum paver, which increases production by mixing two batches simultaneously, one in each of the drums, a new mixing cycle had to be devised. The dual-drum mixer was equipped with two batchmeters, one for the first drum and one for the second. Batchmeter No. 1 was set by the charging skip as the skip reached the top of its rise, just as the batchmeter is set on practically all single-drum pavers. This batchmeter controlled the opening of the transfer chute, which could not be tripped until the time lock released it. Bell No. 1 announced this release.

Tripping of the transfer chute set Batchmeter No. 2, which controlled the mixing period in the second compartment. This timing device locked the discharge chute of the paver and prevented opening of the discharge chute until Bell No. 2 had rung, announcing the end of the mixing period and the release of the locking device.

A period of 8 or 9 sec. is required

**INSPECTOR'S WIRE TOOL** *(left)* **checks depth of reinforcing mat after concrete has been placed without seriously disturbing surface. Engineer holds pocket rule to indicate 2-in. space between reinforcing bar and upper horizontal prong of tool.**

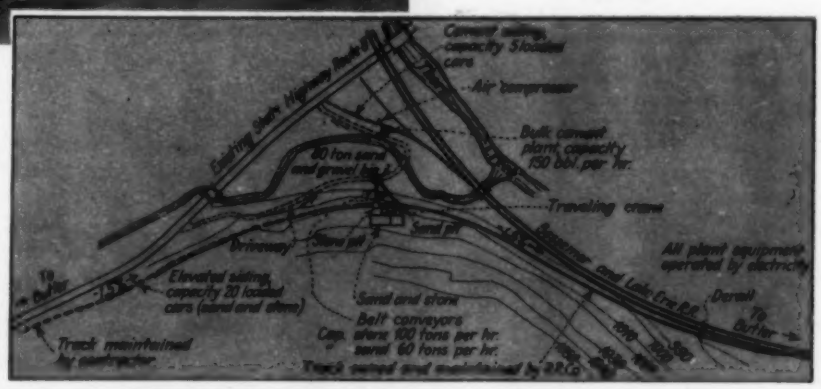
**SIX POWER SHOVELS and 41 trucks, with supplemental bulldozers, blade graders, and rollers, transfer 6,000 yd. per day from cuts to fills.**

**30 TWO-BATCH TRUCKS line up at materials plant for morning's first loads of aggregates. Trucks drive through sand and stone bin and stop under loading pipe of cement plant on way out of yard.**

to pass the batch from the first compartment through the transfer chute into the second. The engineers of the Pennsylvania State Highway Department refused to include this transfer time in the mixing period and required a 44-sec. batchmeter setting for each of the two batchmeters—a total time from skip-up to discharge of 88 sec. This schedule provided a penalty of 4 to 5 sec. to permit the dry materials to slide into the drum after the skip has reached the top of its rise. Although this timing arrangement placed certain difficulties in the way of maximum production on an 88-sec. cycle, the dual-drum paver was able to place mixed batches on the subgrade at a remarkably high rate.

CONTRACTION JOINTS consist of surface slots filled with 2¼x¼-in. premolded asphalt strips placed from deck of rolling bridge.

WELDED BRACKETS *(left)* on steel cement containers prevent trunnion-mounted boxes from clogging floor of body when truck dumps on steep upgrade.


Cement storage capacity 5 loaded cars
Air compressor
Batch mixer
Built cement plant capacity 150 bbl per hr.
Traveling crane
Driveway
Sand pit
Sand pit
All plant equipment operated by electricity
Elevated skiing capacity 20 loaded cars (sand and stone)
Sand and stone Belt conveyors
Track maintained by contractor

LAYOUT OF BATCHING PLANT on old road. Alternate cars of sand and stone stored on hillside track deliver materials simultaneously to track pits, from which belt conveyors transfer them to overhead bins on lower level. All equipment except crane is electrically driven. Trucks drive through plant without backing.

Concrete paving began on June 13 and ended Oct. 12, 1934—a period of four months. In 1,072.24 hr. of job operation, from June 13 to Oct. 12, the dual-drum paving mixer produced 55,821 batches, or an average of 52.06 batches per hour. During this period delays on the job reduced the hours of actual paver operation to 937.11. Using this time as the divisor, the dual-drum mixer produced an average of 59.56 batches per hour of its operation.

On Aug. 21, the mixer produced a maximum volume of concrete for any one day. In 13.08 hr. of mixer operation, the dual-drum paver produced 911 batches, an average of 69.6 batches per hour. Each batch provided concrete for about 1.15 lin. ft. of 30-ft. pavement. Culvert headwalls also were concreted by the mixer in passing, concrete being shoveled from the subgrade into chutes delivering to the headwall forms.

*Placing Concrete*—A subgrade planer pushed in front of the paver cut the subgrade to true profile and final elevation, and a scratch templet behind the mixer checked the subgrade contour and disclosed any high spots. Specifications required that the reinforcement be located accurately in the slab 2 in. below the finished surface. Experience indicated that the steel worked down a considerable distance into the concrete under the oscillating screed of the finishing machine. As a result of a series of trials, the strike-off templet (operated by a power winch on the mixer and used to strike off the lower layer of concrete before placing the reinforcing mats) was set just ¼ in. below the finished surface at the center of the pavement and ¾ in. below the finished surface at each edge.

*Finishing and Curing* — A 30-ft. Lakewood finishing machine equipped with two conventional screeds finished the surface of the concrete slab. On crown pavement, both screeds were used; but on curves, where the pavement flattened, only the front screed was operated, as it could be adjusted by six screws to conform with the desired profile. Behind the finisher two men drew a strip of burlap over the surface to give it a roughened texture.

Two types of floats with handles 15 or 16 ft. long were used by the concrete finishers for the tiring operation of floating 900 ft. of 30-ft. slab per day. One finisher had a float made of a triangular piece of timber 10 ft. long, and the other employed two flat floats made up of 2x6-in. timber planks, one about 6 ft. and the other about 8 ft. long.

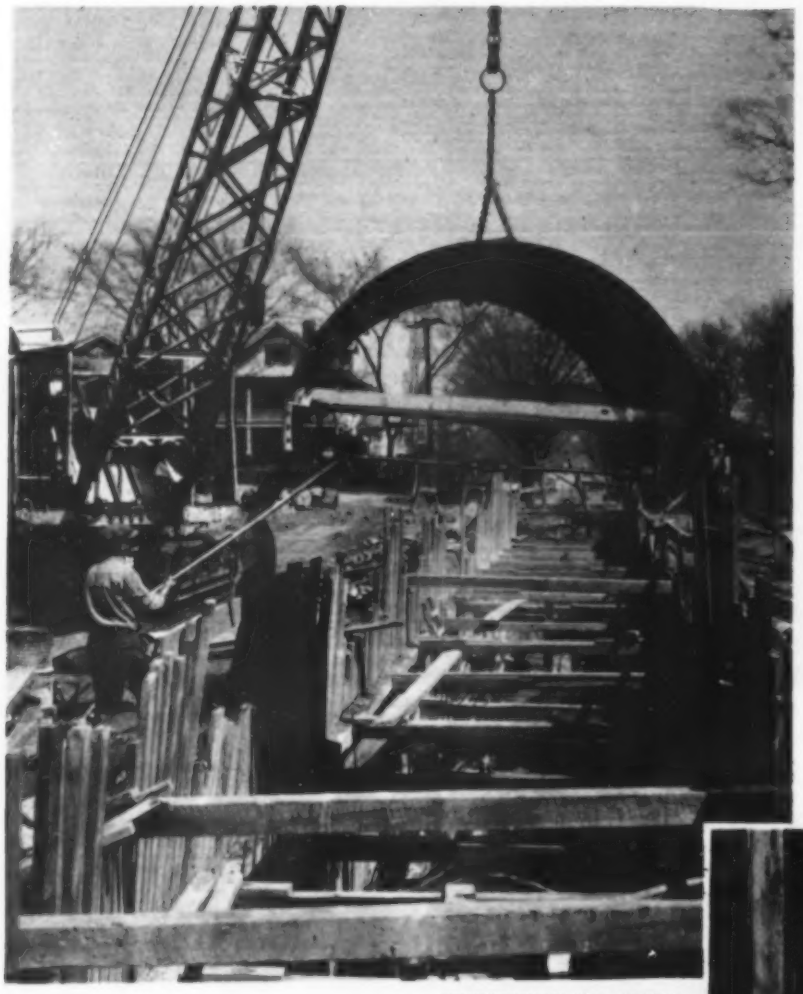
Slots for the longitudinal contraction joints were cut in the surface of the fresh concrete by wheels attached to the rear of the finishing machine on the finisher's final pass over the surface of the slab. The 2¼x¼-in. filler for these joints was installed from the deck of a Flex-Plane rolling bridge, 5-ft. lengths of premolded asphalt being placed end-to-end in the preformed slots. For the transverse contraction joints, similar pieces of filler were clipped together to form a continuous strip. Expansion joints of premolded asphalt ½ in. thick were installed in the usual manner, with dowel bars for load transfer across the joints.

Curing was done with wet burlap and straw. Beams were broken at 8 days, usually indicating a modulus of rupture of 675 to 700 lb. per square inch. Specifications required a breaking strength of at least 550 lb. per square inch. For strengths not much above this figure, the pavement was held for a total period of 14 days following placement before being opened to traffic. For higher strengths, the concrete was opened to traffic at the end of 11 days, if so advised by the central office and laboratory of the highway department.

*Labor Requirements* — Construction Code regulations limited the hours of labor to 40 per week on this project, which was built entirely with state funds. Two shifts were employed. The State Highway Department required the contractor to hire residents of Butler County and set the minimum wage rates for three classes of labor, skilled, semi-skilled, and unskilled. Operations were conducted on a normal 12-hr. schedule, 6 days a week, although the length of the paving day often was shortened or lengthened in accordance with weather or other conditions. As an indication of the amount of human labor required in conjunction with a dual-drum paver, the contractor used a total of 35 men for placing, finishing and curing behind the paving mixer. Four of these men worked in the pit.

*Personnel* — Under Samuel Eckels, chief engineer, and E. J. Finn, district engineer, Indiana, Pa., the project was directed by A. J. Kuhn, project engineer. For the York Engineering & Construction Co., R. W. Smith and S. W. Harbold were in charge of operations, with A. H. Diehl as plant superintendent and J. Williams as superintendent of concrete paving.

# Steel Liner Plates *Aid Sewer*



SEMICIRCULAR ARCH FORM for upper half of 9½-ft. Piney Branch relief sewer, Washington, D. C., is lowered by crane into sheeted trench of open-cut section.

A. F. WAHL *(right)* tunnel foreman at Ninth St. shaft on sewer contract of M. A. Cardo Engineering Corp.

UNSOUND ROCK conditions on the projected location of the Piney Branch relief sewer, in Washington, D. C., now being built by the M. A. Cardo Engineering Corp., of New York City, led the Department of Sanitary Engineering of the District of Columbia to design the tunnel section of this sewer with an outer lining of ¼-in. steel plates installed in advance of a heavy inner lining of concrete. The outer lining of steel plates facilitates construction of the sewer and protects the miners against the hazard of rock falls. Both in the tunnel and in the open-cut sections of the project, the contractor is using steel forms and ready-mixed concrete to construct the walls of the circular sewer.

*Sewer Dimensions* — Two open-cut sections, one 1,860 ft. and the other 350 ft. long, and one tunnel section, 2,840 ft. long, are included in the contract of the M. A. Cardo Engineering Corp. Throughout its length, the sewer has an inside diameter of 9½ ft. In the tunnel section, the steel-plate lining has an outside diameter of 12 ft., and the contractor is paid for rock excavation to this limit. All voids outside the steel lining must be filled with grout without compensation to the constructor. Inside the steel lining, the arch of the sewer, from springing line to springing line, is lined with 15 in. of concrete. Below the springing line, the thickness of concrete is reduced to 10¾ in., and one course of 4¼-in. brick is laid on the concrete, making a total thickness inside the steel of 15 in. For 120 deg. of the invert, the brick lining consists of 4¼-in. vitrified brick. The 30-deg. arcs between this invert and the springing lines, on both sides of the sewer, are paved with 4¼-in. sewer brick.

In the open-cut sections, the sewer has a concrete thickness of 15 in. at the springing line, which reduces to 12 in. at the crown of the arch. Below the springing line, the barrel has a total thickness of 15 in. made up of 10¾ in. of concrete and 4¼ in. of brick, as in the invert of the tunnel section. An alternate design, for open-cut sections in insecure ground, provides a heavy rectangular cross-section for the lower half of the sewer. The outside walls of the sewer are carried down in a vertical plane below the springing line, and the bottom of the sewer is constructed on a horizontal plane 15 in. below the surface of the brick invert.

In addition to the Piney Branch relief sewer, the contract calls for the reconstruction of 354 lin.ft. of old sewer parallel with the new sewer approaching their junction point, 138 lin.ft. of junction chambers, and 285 lin.ft. of branch sewers from 4½ ft. to 12 in. in diameter. The approximate value of the contract is $298,000.

*Open Cut*—Earth excavation in the open-cut sections is taken out with clamshell buckets by a Northwest gasoline crawler crane. The sides of the cut down to rock are retained with solid sheeting. For the rock excavation the contractor uses jackhammer drills and Timken detachable bits. The broken rock is loaded into steel skips for removal by the crane.

Concrete is placed in both invert and arch with Blaw-Knox semi-circular steel forms of two types, one for the invert and one for the arch. These forms, fabricated in 10-ft. lengths by the manufacturer, are lowered into the trench by the crane and are bolted into 20-ft. lengths for the concreting operation. The sewer design in open cut calls for reinforcing bars in two directions in the upper half of the concrete barrel. Agitator trucks discharge ready-mixed concrete by chutes into the forms.

10-FT. SECTION OF STEEL ARCH FORM drops to plank runways on which it will be rolled to position for concreting. Two sections are joined for 20-ft. concrete pour.

# and Steel Forms

# *Construction*

**SHAFT HEADFRAME is equipped with counterweighted chute on which tunnel skip dumps, delivering muck to hopper which loads trucks.**

*Tunnel Work*—Three shafts are serving the construction of the tunnel, with two headings at each shaft. The shafts, which average about 33 ft. in depth to invert grade, are sheeted with 2x12-in. hardwood lumber 12 ft. long and are braced with sets of 10x10-in. timbers inside a 12x12-ft. opening. Over each shaft is erected a timber headframe 50 ft. high equipped with a counterweighted dump chute which delivers skip loads of muck to trucks parked alongside the tower. The posts of the headframe are made up of two 4x8-in. timbers bolted together. With the exception of the cross braces, the headframe is bolted for ease in dismantling.

Excavating methods in the headings depend upon the type of rock encountered, which varies among the headings and from day to day in each heading. Where the rock is soft, the heading crews dig it out with pneumatic concrete breakers and chippers. In dangerous places, poling boards are used above the heads of the miners. When hard rock is encountered, the heading crews drill and shoot the face. All drilling is done by jackhammer drills with Timken detachable bits. A Quimby air-driven centrifugal pump delivers water from the lower heading to a sump at the base of the shaft, where a La Bour electrically powered pump raises it to the surface.

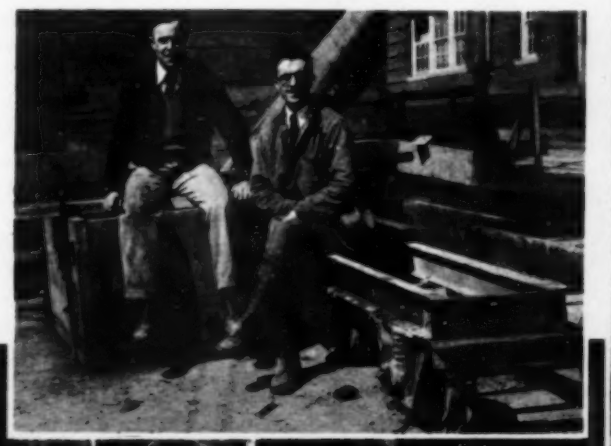
For some distance behind the face, the tunnel roof is blocked up with timber sets, wedges, and longitudinal stringers. Beyond this point the crews set rings of steel plates as the work advances. For this lining the contractor uses Truscon ¼-in. steel plates, each of which covers an area 3 ft. by 1 ft. 4 in. and weighs 40 lb. Twelve plates make up one ring, bolted together through 2-in. flanges on the four edges of each plate. At curves, the sewer is deflected by alternating two tapered rings with every ten straight rings. The width of the tapered rings reduces from 13 17/32 in. at the wide edge to 6 15/32 in. at the narrow edge.

Every third ring of steel plates is equipped with a grouting hole near the crown of the arch. A Ransome grouting machine fills the voids behind the steel lining by forcing a stream of sand-cement grout through these holes.

Collapsible Blaw-Knox steel forms in 20-ft. lengths are employed for concreting inside the steel lining of the tunnel section. A concrete gun developed by the contractor to meet local conditions on the 10th Ave. sewer in New York City is serving again to place concrete in the Piney Branch tunnel.

*Administration* — For the Department of Sanitary Engineering of the District of Columbia, J. B. Gordon is director, A. B. Black is engineer of sewers, and M. J. Bussard is resident engineer on the project. M. A. Cardo is in active charge of operations for the M. A. Cardo Engineering Corp. Prior to his acceptance of a government position, J. A. Connor, superintendent, directed work in the field. William Smith and A. F. Wahl are tunnel foremen, Frank Cirillo is open-cut foreman, and Thomas E. Cardo is assistant superintendent.

**J. A. CONNOR *(left, below)*, superintendent at start of project, and M. J. BUSSARD, resident engineer for District of Columbia, seated respectively on muck skip and tunnel car.**



**THOMAS E. CARDO *(left)*, assistant superintendent, and FRANK CIRILLO, open-cut foreman.**

**TEMPORARY DAM AND STEEL-PIPE FLUME divert flow of existing sewer during construction of junction chamber. Bricklayer paves invert.**

# NEW STEEL FRAME

## *Supports Brewery Tanks*

TO SUPPORT 34 new steel storage tanks and 12 steel fermenters in a remodeled brewery of the City Brewing Corp., New York City, it was necessary to install in the five-story building a special frame of structural steel equipped with brackets upon which the tanks could rest. John M. Canton, of New York City, erected the structural steel and installed the tanks for the Belmont Iron Works, of Philadelphia, subcontractor for this portion of the remodeling under Walter Kidde Constructors, Inc., of New York.

About 134 tons of structural steel was involved in the erection of the new frame to support the tanks. In order to leave the full width of the bays between existing columns clear for the erection of tanks, the new columns were installed in the same vertical planes with the old skeleton frame. This design required that the old floor beams be cut and blocked up to permit the installation of the new columns. Riveted connections then were made between the new columns and the intersected floor beams.

All tanks were designed to utilize the maximum space between rows of columns, with two tiers of tanks on each floor. Storage tanks were 9½ ft. in diameter by 26 ft. long and weighed about 7 tons each. The tanks were delivered to the site on truck trailers and were hoisted to the proper floor in a steel-cable sling by a five-part line suspended from a cantilever beam on the roof. A 35-hp. two-drum gasoline hoist operated the hoisting falls. After landing the tank at the proper floor and working it inside the wall opening, the erectors moved it and raised it to final position with rollers and chain blocks.

Fermenters were delivered to the site in six pieces and were welded in position on the proper floor. All remodeling operations at the brewery were performed under the direction of C. W. Ryan, superintendent for Walter Kidde Constructors, Inc.

**7-TON STEEL STORAGE TANK,** fabricated by welding in shop, is raised by hoisting falls to opening at upper floor in brick wall of old brewery stock house.

**TWO TIERS OF STEEL TANKS** *(left)* supported by new skeleton frame utilize full capacity of old building between columns on each floor.

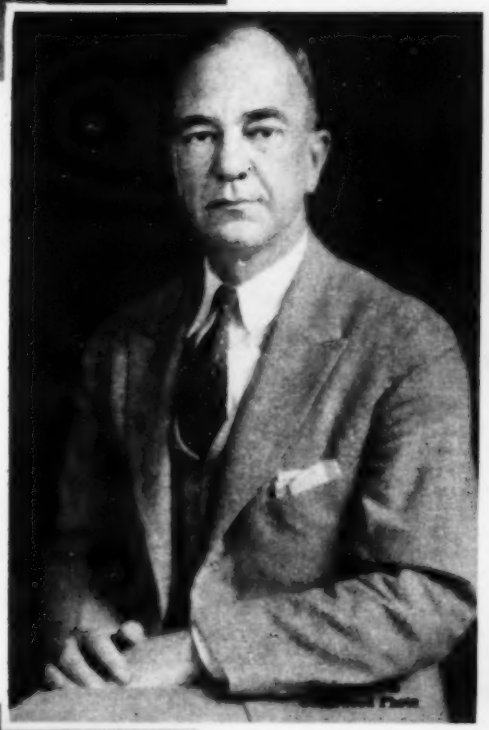
**NEW SUPPORTING COLUMNS** *(right)* for storage tanks, as illustrated by column at left, intersect steel floor joists and beams of old structural frame.

# Present and Accounted For—

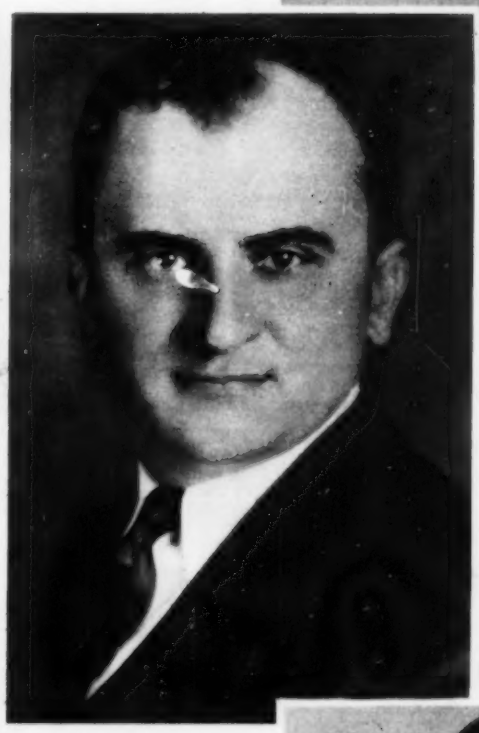
## A Page of Personalities

B. C. LEADBETTER has recently been placed in charge, as division engineer, of Division 4 of 241-mi. long Colorado River Aqueduct, being built by Metropolitan Water District of Southern California.

HARRISON P. EDDY, JR., of firm of Metcalf & Eddy, consulting engineers, of Boston, is newly elected president of American Society of Municipal Engineers.



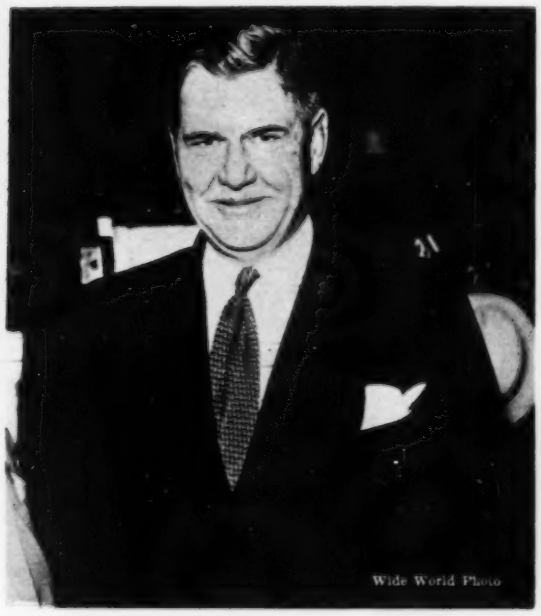
LIEUT.-COL. DANIEL I. SULTAN *(right)* Corps of Engineers, U. S. Army, has been appointed engineer-commissioner of District of Columbia, succeeding Major John C. Gotwals.



ERNEST J. BOHN *(left)*, member of City Council of Cleveland, Ohio, and former Ohio State assemblyman, has been elected president of National Association of Housing Officials. Mr. Bohn is co-author of and largely responsible for passage of Ohio's Housing Authority Act, first of its kind in United States.

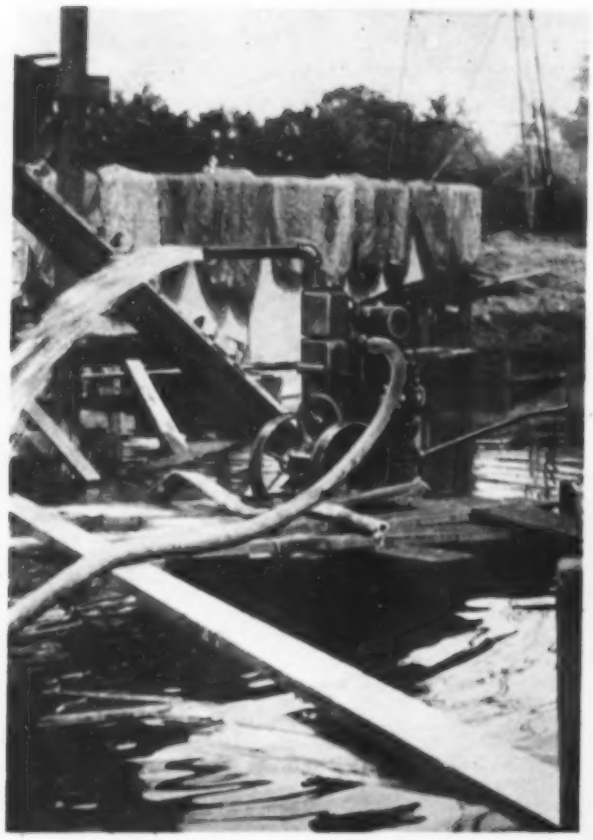
BEN ARP is serving as superintendent for Utah Construction Co. on its contract for West Iron Mountain tunnel of Colorado River Aqueduct, in California for Metropolitan Water District of Southern California. His inclination to spend most of his time underground while work is in progress has led his tunnel crews to refer to him as the "human mole".

GEORGE H. BUCKLEY *(below)*, of Iowa, was recently appointed administrative assistant to James A. Moffett, Federal Housing Administrator. Central aim of organization is to make home financing, on reasonable terms to borrower, immediately and permanently safe and attractive to private capital.



HERBERT KNAPP, formerly connected with U. S. Engineer District office at Memphis, Tenn., has been appointed safety engineer on Norris dam, Tennessee Valley Authority project on Clinch River.

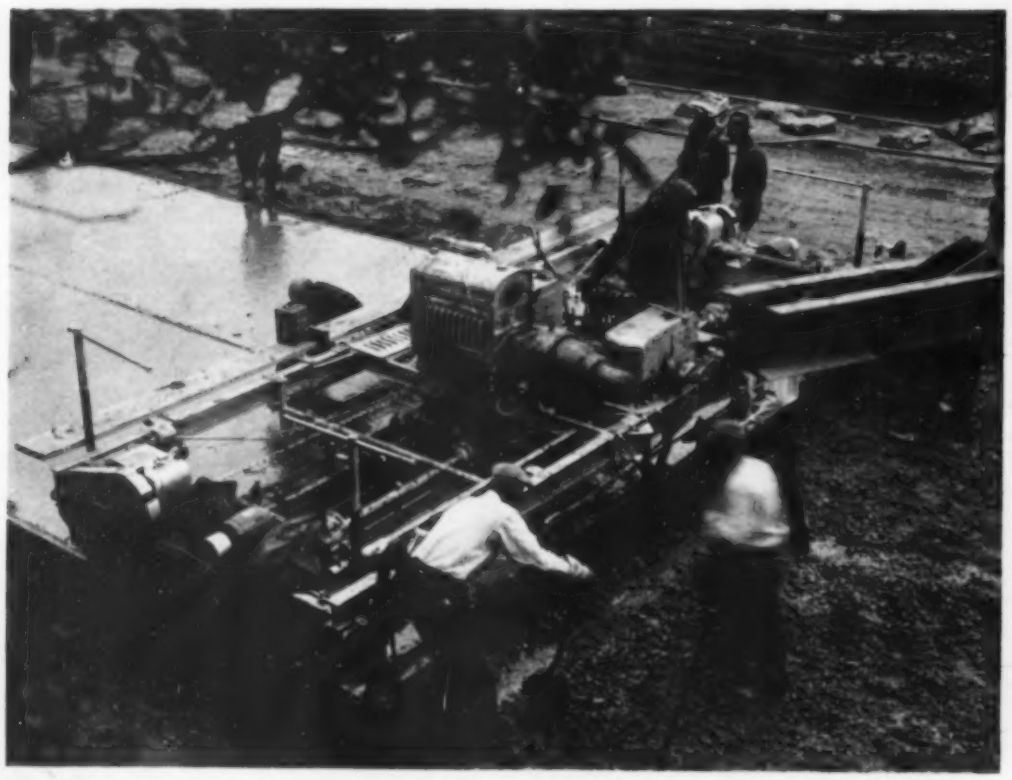
# NEW EQUIPMENT ON THE JOB

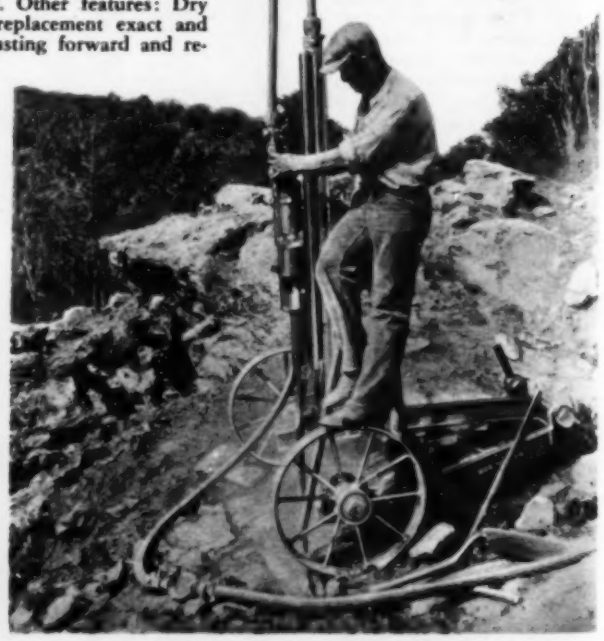


8,500 GAL. PER HOUR at 10-ft. head is guaranteed capacity of this 2-in. self-priming centrifugal pump powered by water-cooled 2½-hp. single-cylinder engine. Pump discharge pipe passes through engine hopper, thus keeping engine cooling water always at proper temperature. Pump has no packing, seal being maintained by two leather seals on impeller shaft. Supplied with skid- or two-wheel-truck mountings.—Novo Engine Co., Lansing, Mich.

DUAL STEERING CONTROL providing quick effortless hydraulic power steer that can be changed instantly to dependable hand steer is outstanding improvement on new 6-cylinder, three-speed hydraulically operated road roller. Other features: Dry removable cylinder sleeve makes bore replacement exact and easy; precision engine bearings; self-adjusting forward and reverse clutches; low pressure hydraulic system does away with leaky joints and blown out connections; short turning made possible by front arch construction, and three speeds in both directions ranging from approximately ¾ to 6 m.p.h. through governor control.—Huber Manufacturing Co., Marion, O.

VIBRATION ATTACHMENT for Blaw-Knox 20-ft. wide gas-electric concrete pavement finisher *(below)* consists of two independent 10-ft. units, each operated by separate motor drive and equipped with two vibrating elements, making total of four. During first trip concrete is struck off with front screed and simultaneously vibrated down to level of top of form. Pavement then is double screeded in usual manner. Entire vibrator and finishing process controlled by one operator.—Blaw-Knox Co., Pittsburgh, Pa.





WAGON DRILL, known as "Rock Master", developed to speed up classes of drilling which require light-weight, mobile rig. Readily adaptable for down-hole drilling, line drilling, hillside drilling, side-hole drilling and snake-hole drilling. Used extensively for deep-hole drilling up to 20 ft. supplemented by hand-held drills for boulder popping. Equipped with quick and effective hole-spotting device. Furnished with feeds to accommodate a 3-, 4-, or 6-ft. maximum steel change. Can be equipped with various Worthington pneumatic feed drifters in either wet or dry types.—Worthington Pump & Machinery Corp., Harrison, N. J.

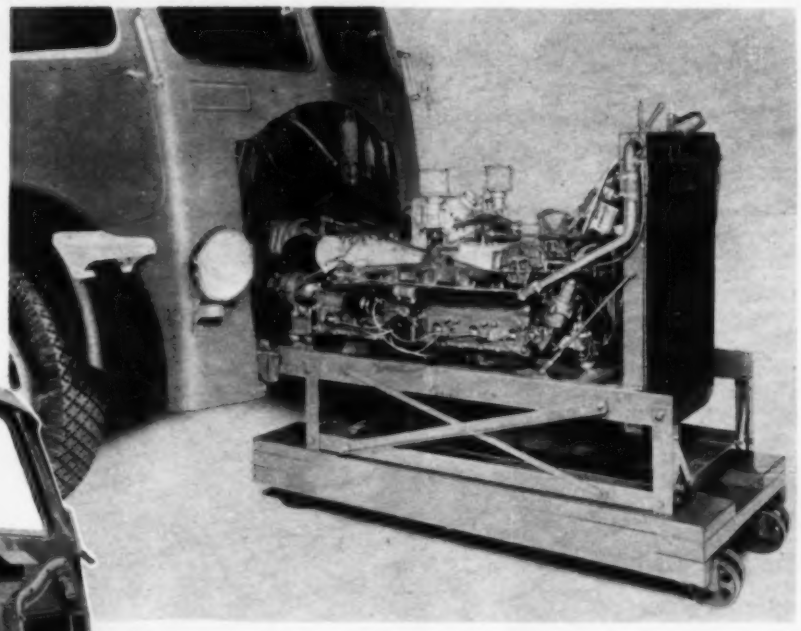
***If You Want Further Information —***

**Within the space limits of this page it is impossible to present complete information about the products illustrated.**

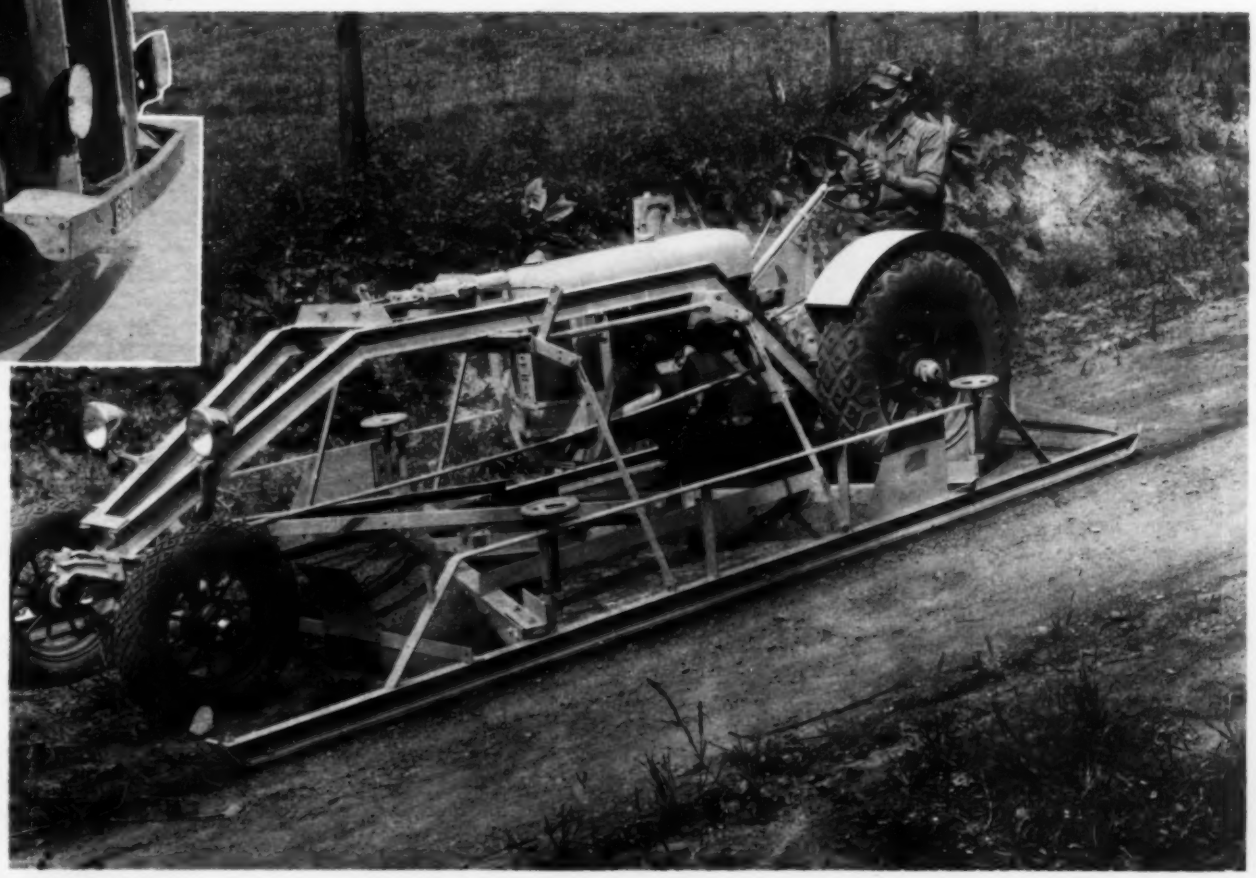
**The manufacturers, however, will be glad to supply further details if you will write to them.**

**AUXILIARY ROLL of small diameter, attached to Hercules three-wheel roller in place of scarifier, assures 17-ft. long plane which properly compacts newly placed paving materials and assures a smooth, level road surface free of wheel marks. Roll is hydraulically operated, is roller-bearing mounted and has great flexibility of operation with range from -6 in. to 6½ in. above grade. Hydraulic pressure range is from 0 to 300 lb. In operation weight equal to more than 50 per cent of weight of entire roller may be exerted on this auxiliary roll. Positive power control automatically maintains necessary traction on rear driving wheels—Hercules Co., Marion, Ohio.**

**CLOSED-BACK SHOVEL *(right)* has steel plate welded securely to blade extending up into socket. Upper part of plate, however, is free to permit flexing. This construction makes one-piece steel blade smooth both front and back and yet permits use of tapered socket which is heat-treated to provide greater strength and springiness than solid shank offers. This type of socket also makes possible lift or bend usually found only in plain back shovels. Other features: straight handle, making replacement easy, and turned shoulder, eliminating blade splitting and providing foot comfort for workers. —Wood Shovel and Tool Co., Piqua, Ohio.**



**12-CYLINDER HORIZONTALLY OPPOSED ENGINE mounted *(left and in inset)* under driver's cab is feature of new line of heavy-duty trucks for which makers promise unusually low cost of operation and maintenance. Additional advantages:—Short overall length—wheelbases 108 to 180 in. for bodies 11 ft. to 21½ ft. long; level cab floor; balanced load distribution; sufficient ventilation and comfortable temperature in cab (exhaust manifolds on under side); easy accessibility of engine; satisfactory visibility for driver; short turning radius. Speed 55 mi. per hour, with engine speed of 2,400 r.p.m. Gross weights, 24,000 to 30,000 lb. Horizontally opposed engine increases life of pistons and cylinders due to reduction in piston speed; of valves because of their position in relation to cooling system; of bearings due to automatic balancing out of destructive forces and lower unit pressures. Also increases margin of mechanical safety in all kinds of operation.—The White Co., Cleveland, Ohio.**



**ROAD SHAPER *(right)*, for leveling highways, race tracks and similar surfaces, consists of two blades and two straight-edges hung from tractor by steel frame. Blades are set at opposing angles to provide shearing action from two directions to remove corrugations and irregularities and follow the road surface through action of 15-ft. straight-edges which keep them running evenly at uniform depth. Effective working width, 7 ft. Shaper raised by hand hydraulic lift and lowered when in neutral position. Easily and quickly detached from tractor. — Fate-Root-Heath Company, Plymouth, Ohio.**

# How many do you remember?

## (*A Lesson for Advertisers*)

ABOVE are listed ten of the best-advertised people of the year 1929. They made newspaper front pages all over the land—which is more than money can buy for any advertiser.

Yet how many can you identify today?

If your advertising ceased when the New Era passed out, and you're under the impression that your prospects haven't forgotten you, let this be a gentle reminder. Not only have 1929's buyers forgotten what you told them five years ago, but today there's a new crop of buyers who never even saw those sales messages of yours!

If your product is worth selling today, it's worth advertising today. Those who sell to business and industry can do it for a modest sum . . . if they choose the "waste-proof way"—through McGraw-Hill Publications. Here you pay to reach the men who buy, and only the men who buy, in the worthwhile companies in your field.

Give your product a break, your sales force some inspiration, your competitors some real competition—with consistent advertising in McGraw-Hill publications.

*Just so they won't keep you awake tonight* . . . 1. Captain of the S. S. America, who made a thrilling rescue at sea . . . 2. Seattle girl who married a Hindu Monarch . . . 3. Northampton, Mass., philosopher cobbler and friend of Pres. Coolidge . . . 4. Sister of Vice-President Curtis . . . 5. Governor of Massachusetts at time of Sacco-Vanzetti trial . . . 6. Flier who crossed the Atlantic with Roger Q. Williams . . . 7. Commander of the Graf Zeppelin . . . 8. Was married to John Coolidge . . . 9. Asst. U. S. Atty. Gen. in charge of prohibition enforcement . . . 10. 100-year old Grand Sachem of Tammany Society.

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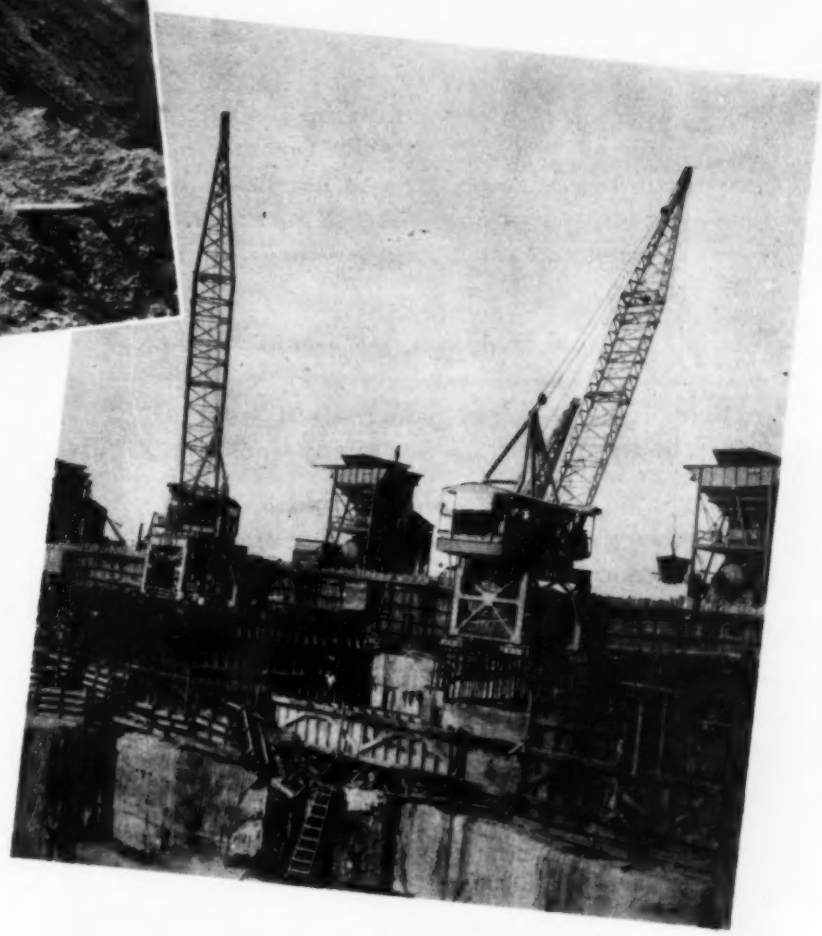
## WILEY-WHIRLEYS

For stripping, aggregate reclamation and general dragline excavation, the Clyde Wiley-Whirley can be used economically for low cost production.



For placing concrete, handling forms and for hook work and clam shell operations on large construction projects, the Clyde Wiley-Whirley is preferred. Wherever Whirleys are used — Clyde Wiley-Whirleys predominate.

CLYDE

## CLYDE SALES CO.
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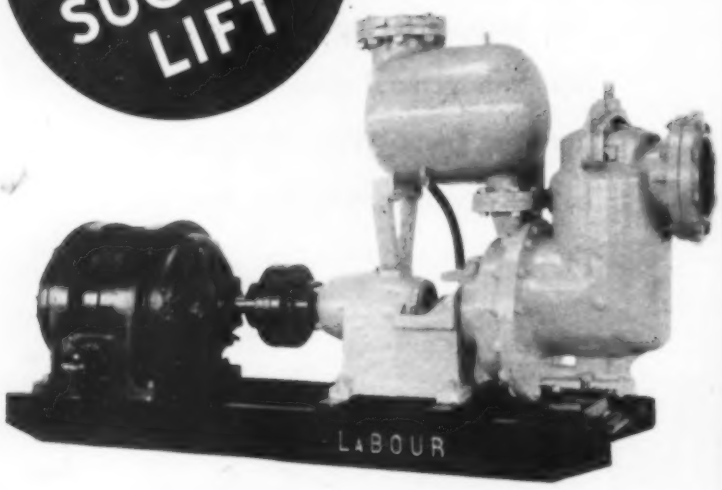
# 1500 GPM

# 20 FOOT SUCTION LIFT




**This compact, husky LaBour pump is exactly what you need if your job calls for moving large quantities of water. It will handle 1500 honest gallons per minute—at *full suction lift* if necessary — and yet it requires surprisingly little space.**

**This is a genuine Hydrobalance® pump, which means that it has no valves, floats, or other auxiliary apparatus, yet primes itself without a drop of waste recirculation at any time.**

**LaBour pumps are simple, dependable, and they deliver full rated capacity. They are made in sizes from 10 gallons per minute up to the model illustrated above, and operate with electric motors, gasoline engines, steam turbine or belt drive. Details will be supplied on request.**

® Trade Mark Reg. U.S. Pat. Off.

## The LaBour Company, Inc.

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laBour



**NATIONAL CARBIDE**

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Most Light
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Quickly Charged

Easily moved—No wires
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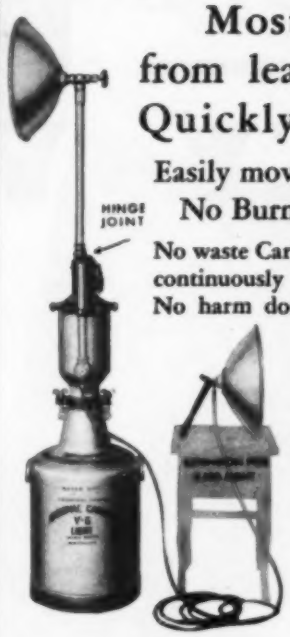


No waste Carbide whether used continuously or intermittently
No harm done if tipped over

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Extension to
X-100
DOUBLES THE
CANDLE POWER
*fastens anywhere*

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**Y199**
**NATIONAL CARBIDE V-G HANDY LIGHT**
Burns about 5½ hours on 1¾ lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c.p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

**WL1-C1**
**NATIONAL CARBIDE LANTERN**
Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

**X-100**
**NATIONAL CARBIDE V-G LIGHT**
About 8,000 c.p. for 12 hours on 7 lb. charge of National Carbide. Easily handled by one man. Weight 35 lbs. empty; 90 lbs. full.

**NATIONAL CARBIDE SALES CORP.**
LINCOLN BUILDING
*Opposite Grand Central,* NEW YORK



*Annual*

# HIGHWAY NUMBER Construction Methods

# JANUARY 1935

*Editorially* — of tremendous value to its readers who are vitally concerned in modern road building and maintenance methods.

*Advertisingly* — an opportunity of exceptional value to manufacturers seeking business in the road building field.

# KOEHRING

## Maintains Progress

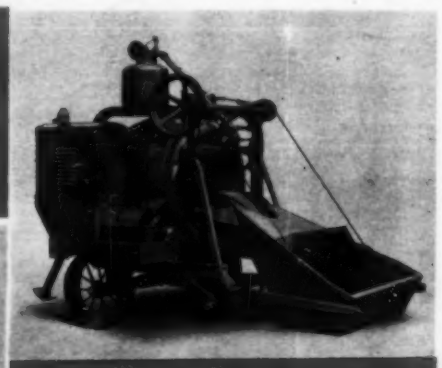
KOEHRING Company has maintained its March of Progress during 1934. In addition to improvements and developments in Pavers, Dumptors, Mud-Jacks, Shovels, Cranes and Draglines —

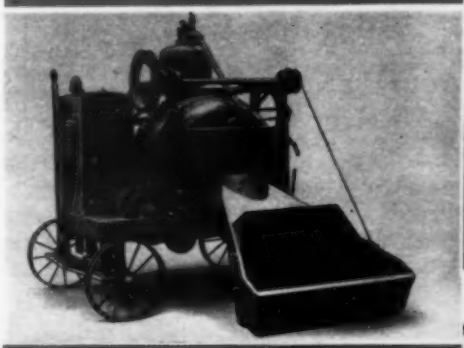
A complete line of concrete mixers — newly designed for modern requirements — Sizes 7-S to the 84-S.

The Koehring Dandie Mixers, 7-S, 10-S, 14-S — 4 wheel and trailer type — are exceptionally light in weight — full spring mounted — short in overall length and width.

The Heavy Duty Construction Mixers — full anti-friction bearing — compact design — short frame with power mounting underneath charging chute — equipped with the distinctly new Koehring Flow-Line Discharge.

**KOEHRING DANDIE MIXER**
7-S — 2,870 pounds
10-S — 3,800 pounds
14-S — 4,950 pounds
Automatic Skip-Flow Shaker

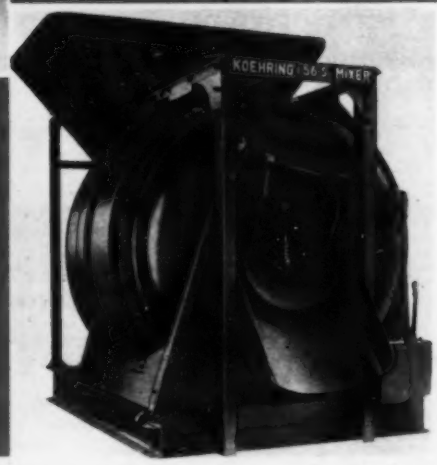




**KOEHRING DANDIE TRAIL-MIX**
7-S — 2,950 pounds
10-S — 4,000 pounds
Automatic Skip-Flow Shaker

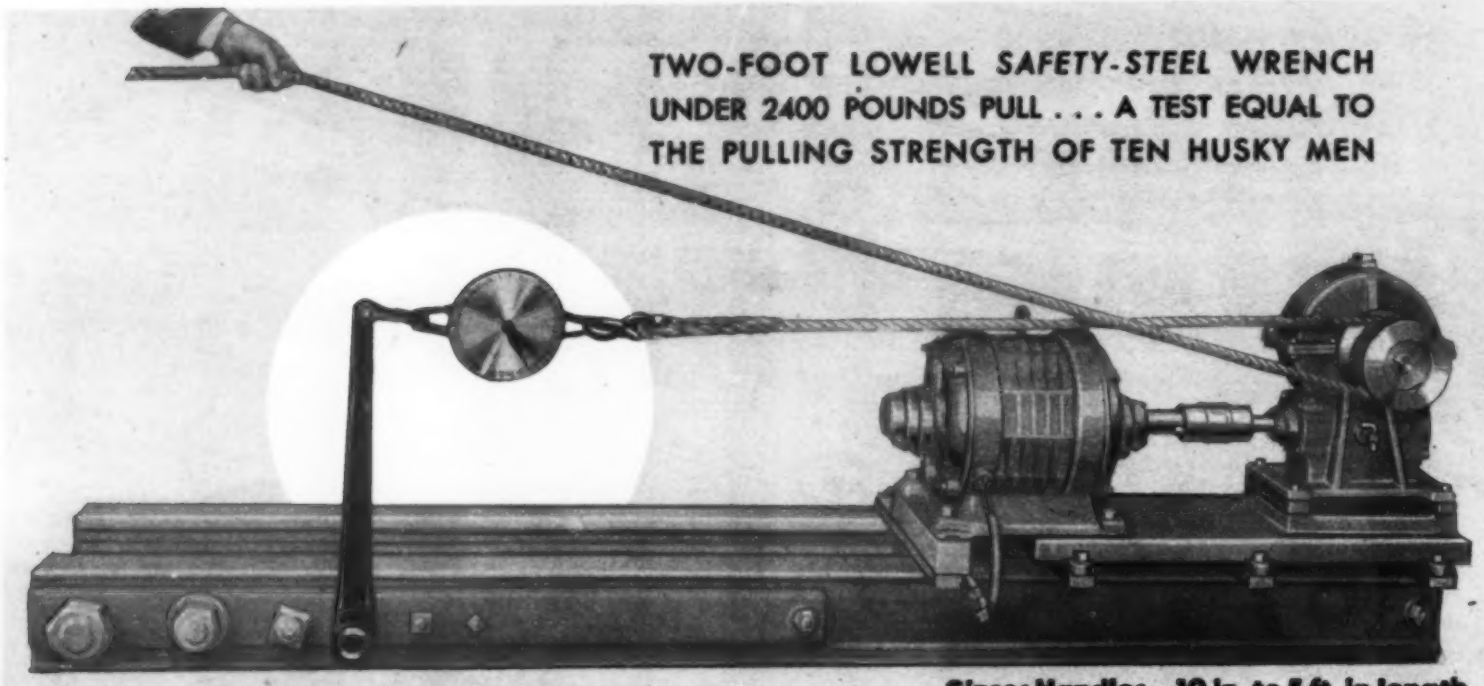
**KOEHRING HEAVY DUTY CONSTRUCTION MIXERS**

Sizes 28-S, 56-S and 84-S with the Koehring Re-Mixing Action—simplified, high speed, power discharge — Multiple V-Belt drive — automatic water tank and batchmeter optional equipment.




The Koehring Flow-Line discharge — a revolutionary departure from the conventional arrangement — greatly decreases discharge time — causes a minimum of segregation — substantially reduces abrasive wear. It allows a wider expanse of chute, lessens the height of drop to a minimum and permits an unbroken, natural flow of concrete from the bucket to the distributing system . . . The tilted and widened discharge chute reaches far and high into the drum, immediately below and across the full width of buckets — to receive practically the full load of each bucket in one drum revolution.

**KOEHRING COMPANY**
MILWAUKEE *Division of National Equipment Corporation* WISCONSIN



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We make actual tests in our plant.
No guess work as to what our Wrenches will stand.

*Sizes:* Handles—10 in. to 5 ft. in length
Nut Sizes—½ in. to 9⅛ in. in diameter

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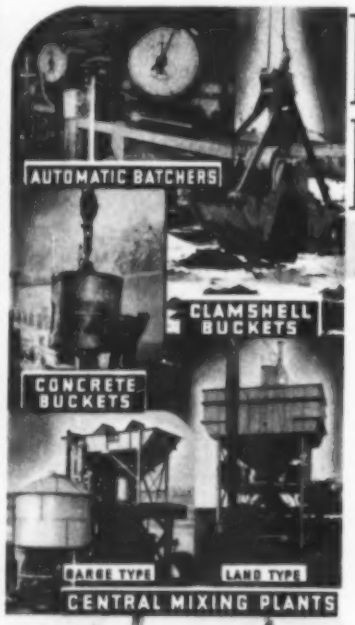


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*FOR FASTER MORE PROFITABLE WORK*

Blaw-Knox equipment helps the contractor to maintain schedules and complete his work on time. It is low in maintenance cost and pays for itself quickly in service. It is modern and in many instances has anticipated specifications. Blaw-Knox equipment helps the contractor to make profits in the face of severe competition. It's a twenty-eight year old custom among contractors to "deal with Blaw-Knox." This is an especially good habit to continue as it marks the maximum worth in equipment, satisfaction and service to be obtained for the dollar expended.

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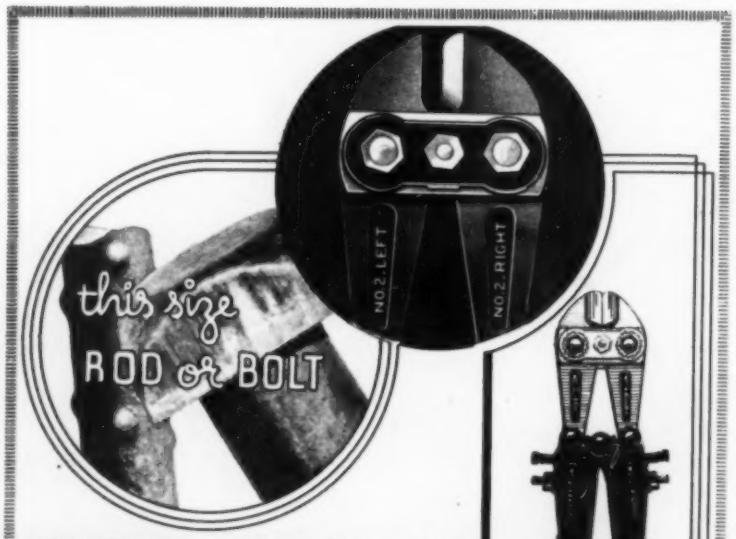
1688 Farmers Bank Building - - Pittsburgh, Pa.
Offices and Representatives in Principal Cities

# BLAW-KNOX



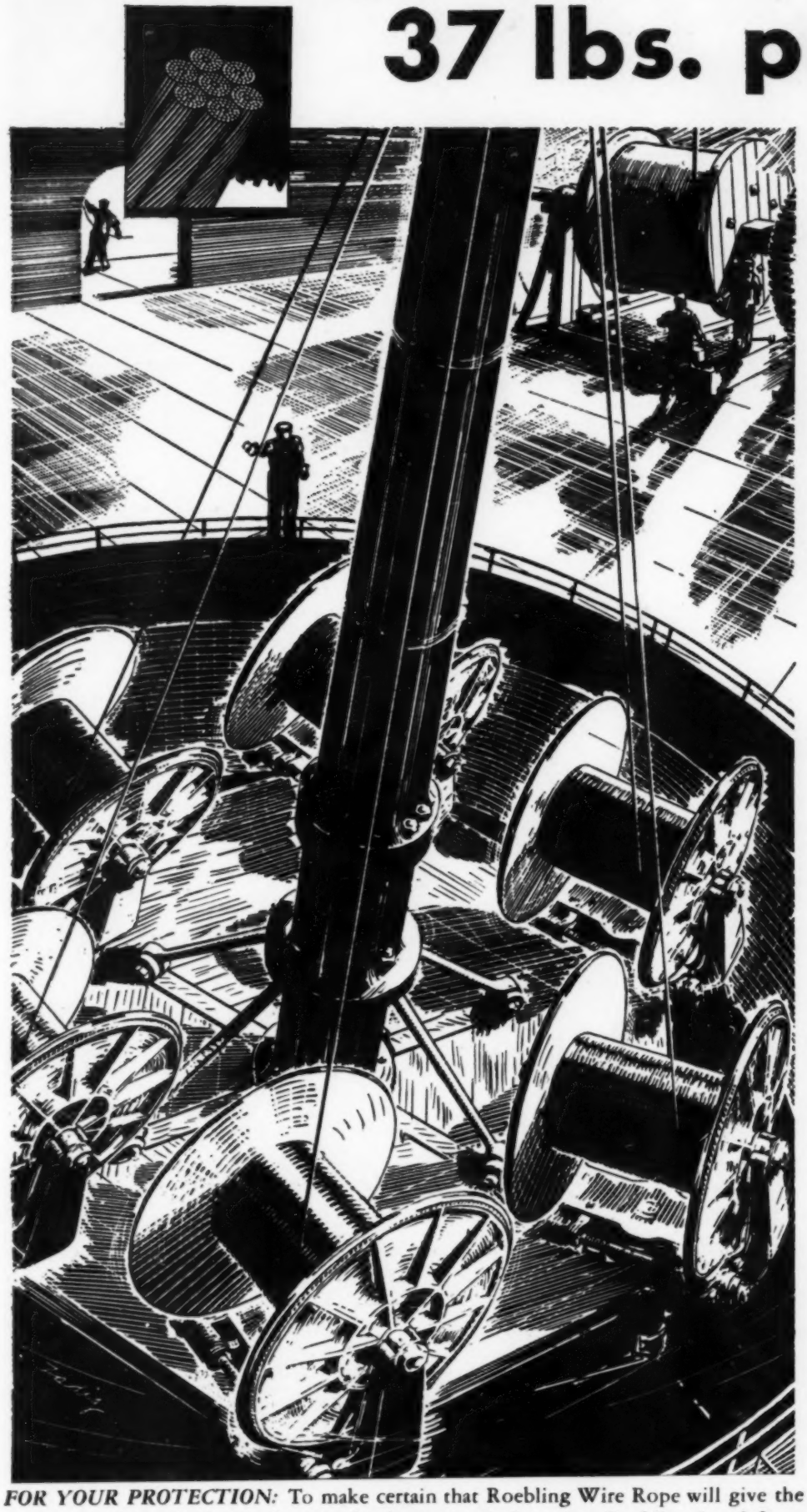

# PORTER HKP portable two hand CUTTING TOOLS

Cut a bolt as large as the one pictured above — anywhere on the job. Cut rods, cable or flat stock in one operation — in the fraction of a minute — with the Porter tool designed for this purpose. Cut stay rods and tie wire in concrete work — heavy nails and bolts in forms and scaffolding — all sorts of rods, heavy wire, chain, etc. in wrecking work, maintenance repairs, production, etc. There is a Porter tool for every requirement — special models for special needs.

*Write for catalog.*
*Ask your supply house or jobber.*

H. K. PORTER, INC. Everett, Mass.

# Rope that weighs 37 lbs. per foot!

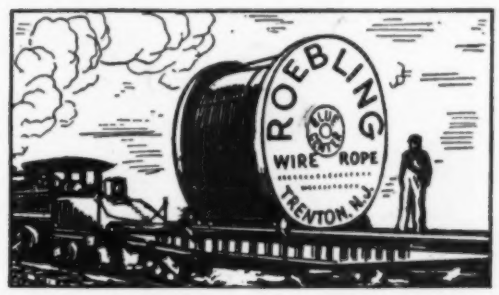


### MADE BY WORLD'S LARGEST "ROPE-CLOSING" MACHINE

In rope diameter, the capacity of this Roebling machine is practically unlimited. It can turn out 80 tons of rope *in a single length* without reloading. A 4¾" wire rope, soon to be made by this machine, will weigh close to 37 pounds per foot! This "closing" machine is one of many of various types used by Roebling.

**2525 MILES OF WIRE**

A single 8½ mile length of 1½" Roebling 6 x 19 wire rope, with a 7 x 19 independent wire rope center, such as could be produced by this machine without reloading, would contain 2525 miles of wire, approximately the air-line distance from New York to San Francisco.




**61 TONS ON A SINGLE REEL**

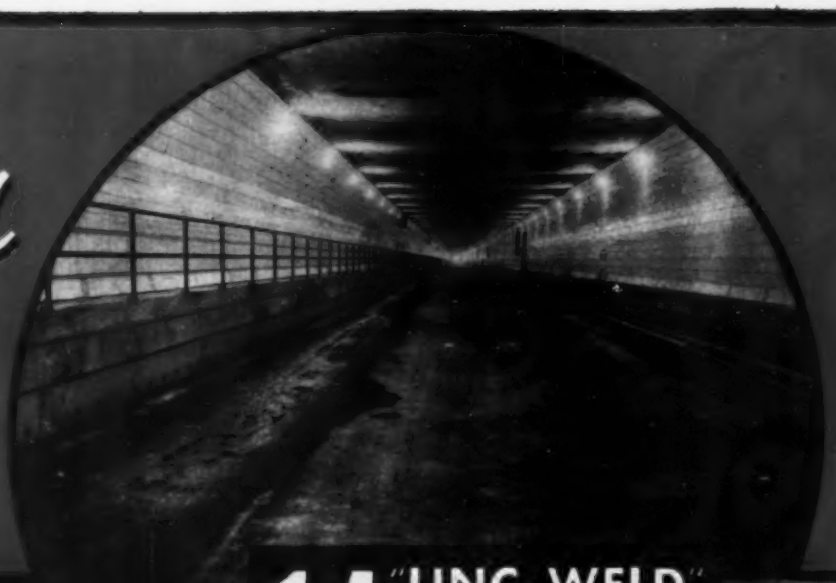
Drawn from actual photograph of a shipment of Roebling 1½" diam. Blue Center Wire Rope. The rope, made by the machine shown, is a *single* piece almost 6½ miles long.

**4¾" AND 2⅝" WIRE ROPES FOR NEW GOLDEN GATE BRIDGE WILL BE MADE ON THIS MACHINE**

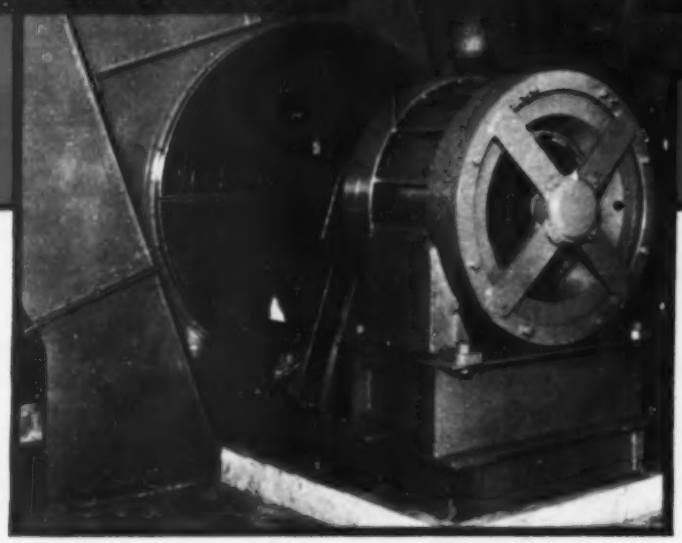
*FOR YOUR PROTECTION:* To make certain that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has left no stone unturned. It has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. This rope-making machine is an example. John A. Roebling's Sons Company, Trenton, N. J. Branches in Principal Cities.

## ROEBLING . . . THE PACEMAKER IN WIRE ROPE DEVELOPMENT

# Fresh Air here



**14** "LINC-WELD" MOTORS LIKE THIS . . . DRIVE EXHAUST FANS



**14** "LINC-WELD" MOTORS LIKE THESE . . . DRIVE THE BLOWERS

## in Boston-East Boston Vehicular Tube

Again, where human lives are at stake, "Linc-Weld" motors are placed on the job. The two latest underwater vehicular tunnels to be completed—first the Geo. A. Posey tube between Oakland and Alameda, Calif., and now the world's largest, the Boston-East Boston tube—depend on "Linc-Weld" motors to keep the air fresh and remove all danger of asphyxiation. Twenty-eight "Linc-Weld" two-speed squirrel cage type motors drive the fans and blowers which handle as high as two million cubic feet of air per minute, changing all the air in this newest tube 40 times every hour.

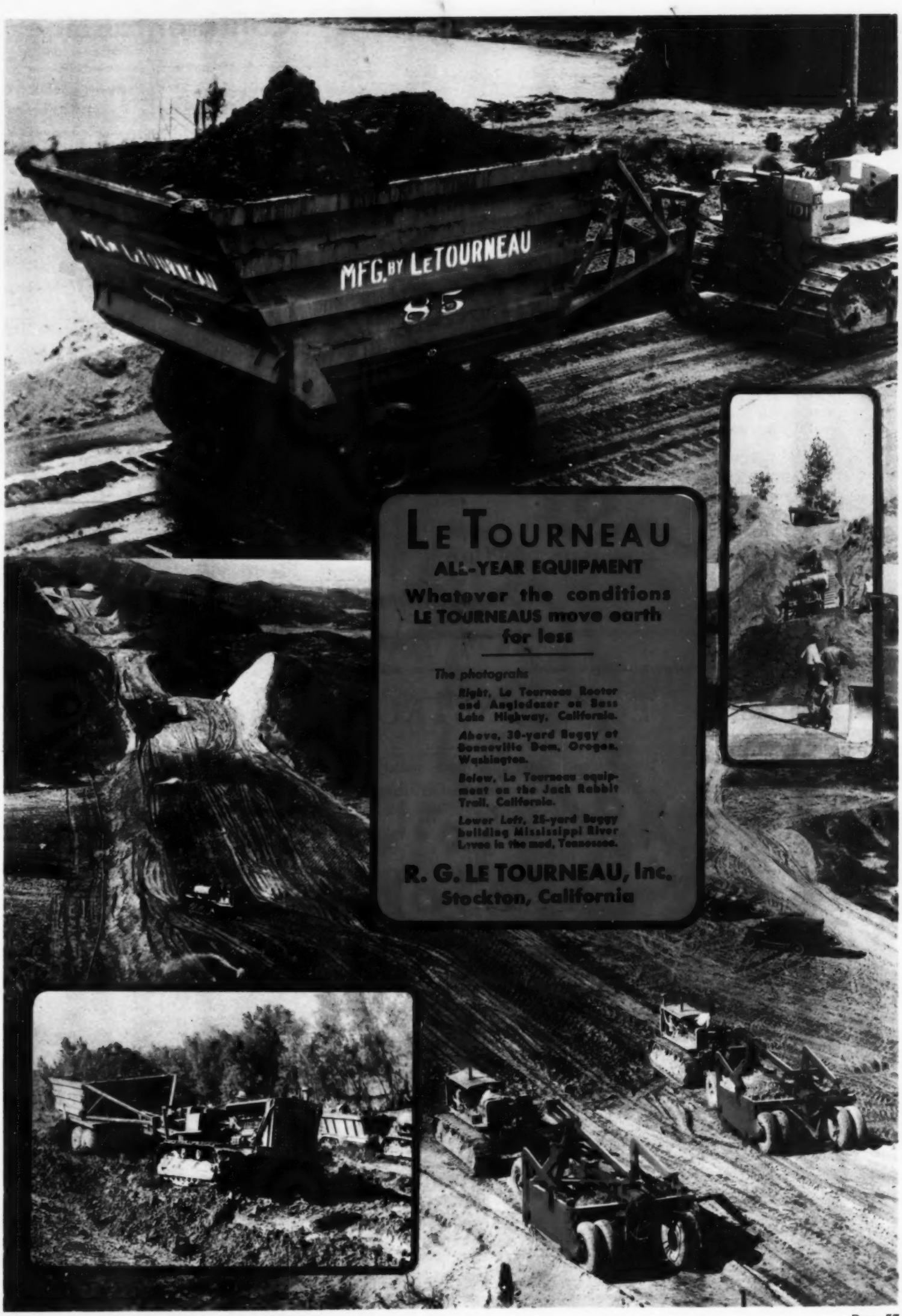
To meet specification demands for extra high efficiency and power factor required only Lincoln's usual standards of design, materials and construction as applied to all types of "Linc-Weld" motors. Thus you, too, can obtain dependability plus improved operating characteristics of "Linc-Weld" motors for your equipment.

# LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

*Manufacturers of "Linc-Weld" Motors and "Shield-Arc" Welders*

M-14




# LE TOURNEAU

**ALL-YEAR EQUIPMENT**

**Whatever the conditions LE TOURNEAUS move earth for less**

*The photographs*

*Right*, Le Tourneau Rooter and Angledozer on Bass Lake Highway, California.

*Above*, 30-yard Buggy at Bonneville Dam, Oregon, Washington.

*Below*, Le Tourneau equipment on the Jack Rabbit Trail, California.

*Lower Left*, 25-yard Buggy building Mississippi River Levee in the mud, Tennessee.

**R. G. LE TOURNEAU, Inc.**
**Stockton, California**

# Something New in Bulldozers

The Continental Bulldozer (Wooldridge Patents) offers these outstanding features:

1. Blade can be tilted without the operator leaving the tractor seat.
2. Bulldozer is pushed direct from tractor drawbar.
3. Blade is powered both up and down.
4. Can be converted into a Continental Trailbuilder at small cost.
5. Snowplow blade can be attached to bulldozer frame.
6. Fabricated primarily from dynamic steel.

## Continental Roll & Steel Foundry Co.

***Industrial Equipment Division***

CHICAGO 332 South Michigan Ave. ILLINOIS

General Offices: East Chicago, Ind.

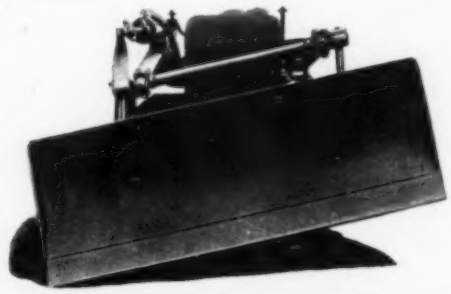
## Continental Line

The line of Continental equipment, designed for hydraulic operation with crawler-type tractors, includes Bulldozers, Trailbuilders, Rippers, Pick-Up-and-Carry Scrapers and Snowplows. Write for details.

## The Blade Tilts

The blade is hydraulically powered—up and down—or held in any desired position. The operator can tilt the blade as shown below. This makes it possible to grade while the dirt or other material is bulldozed. This is a most desirable feature that speeds up work and reduces equipment outlay.

Continental Bulldozers are built of dynamic steel—developed for equipment subjected to continuous shock.



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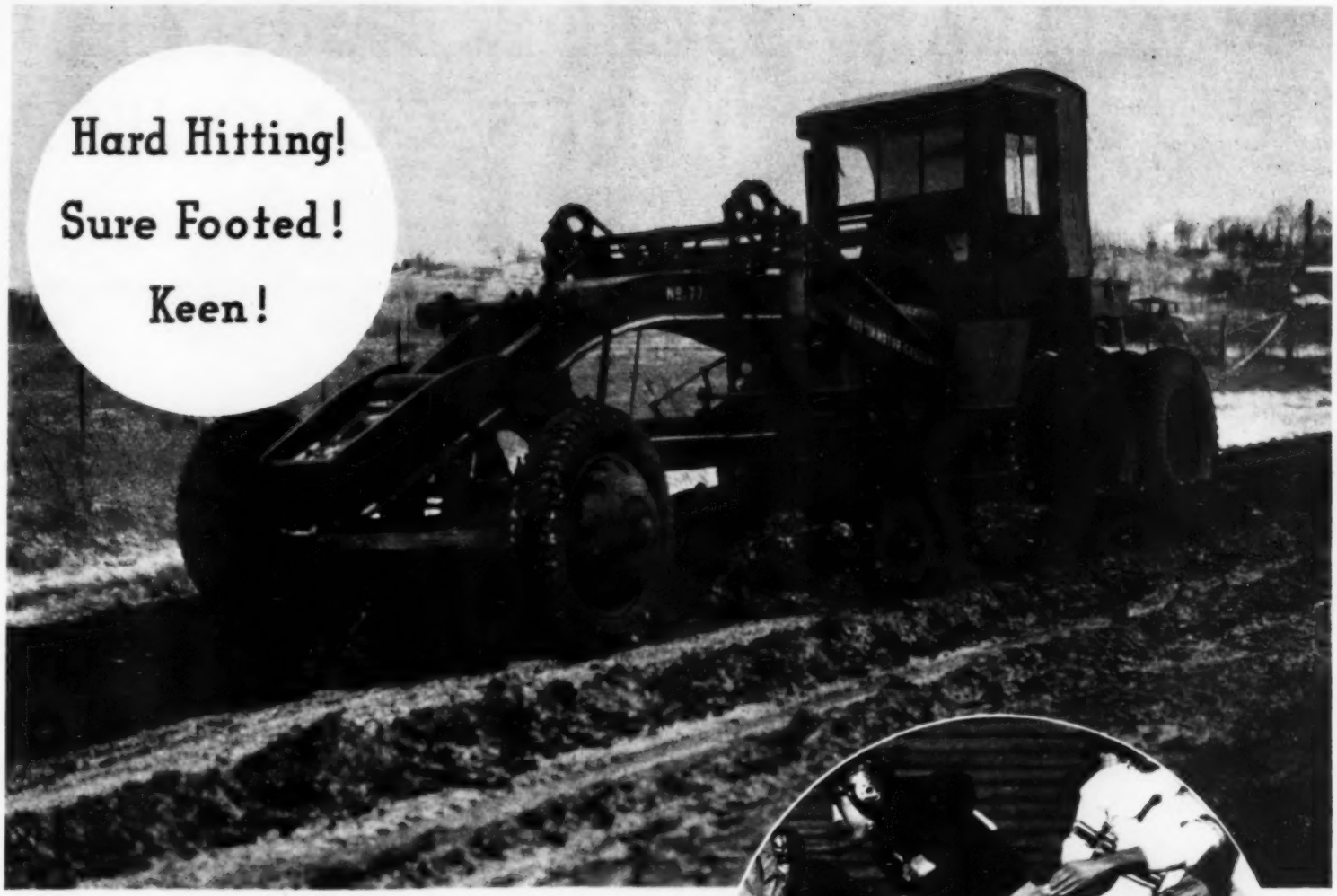

Acme Photo

# THE GROUND GAINERS go through!

● To gain ground against any resistance is the winning quality—in road machinery as it is in a football star. Highway contractors and maintenance men have discovered that "Austin 77" is the signal to go over the goal line.

The Austin 77's dual traction, held to the road by sufficient weight and backed up by a full-powered 6-cylinder motor (oil-burning optional) puts the blade "through." And, there's no flinching or slippage at the blade; the wide front axle with leaning wheels equalizes the load, holds to the job. As a change of pace from heavy ditching jobs, the six speed transmission provides many speeds through that suitable for highway patrol service to a special high speed for in-between-job travel.

An oil mix job—only one of the 6 types of work for which the "Austin 77" is made.

The range of work to which the "Austin 77" can be applied with fully satisfying results is enormous. Its versatility (for oil mix, snow removal, grading, ditching, scarifying, etc.) helps this single unit to pay for itself six times as fast as any single purpose machine. Send the coupon for details.

**The Austin-Western Road Machinery Co.**

Home Office: Aurora, Ill. Cable Address: AWCO, Aurora

*Branches in Principal Cities*

**Austin-Western**

ROAD ROLLERS CRUSHING & SCREENING PLANTS SCARIFIERS SWEEPERS & SPRINKLERS ROAD GRADERS ELEVATING GRADERS MOTOR GRADER DRAGS SHO WAGONS

The Austin-Western Road Machinery Co.
A 6 Aurora, Illinois
Please send me full details about "Austin 77."
Name .....
Firm .....
Address ..... State .....
City .....

**Cletrac Tractors**
Sold and serviced in this territory by Austin-Western

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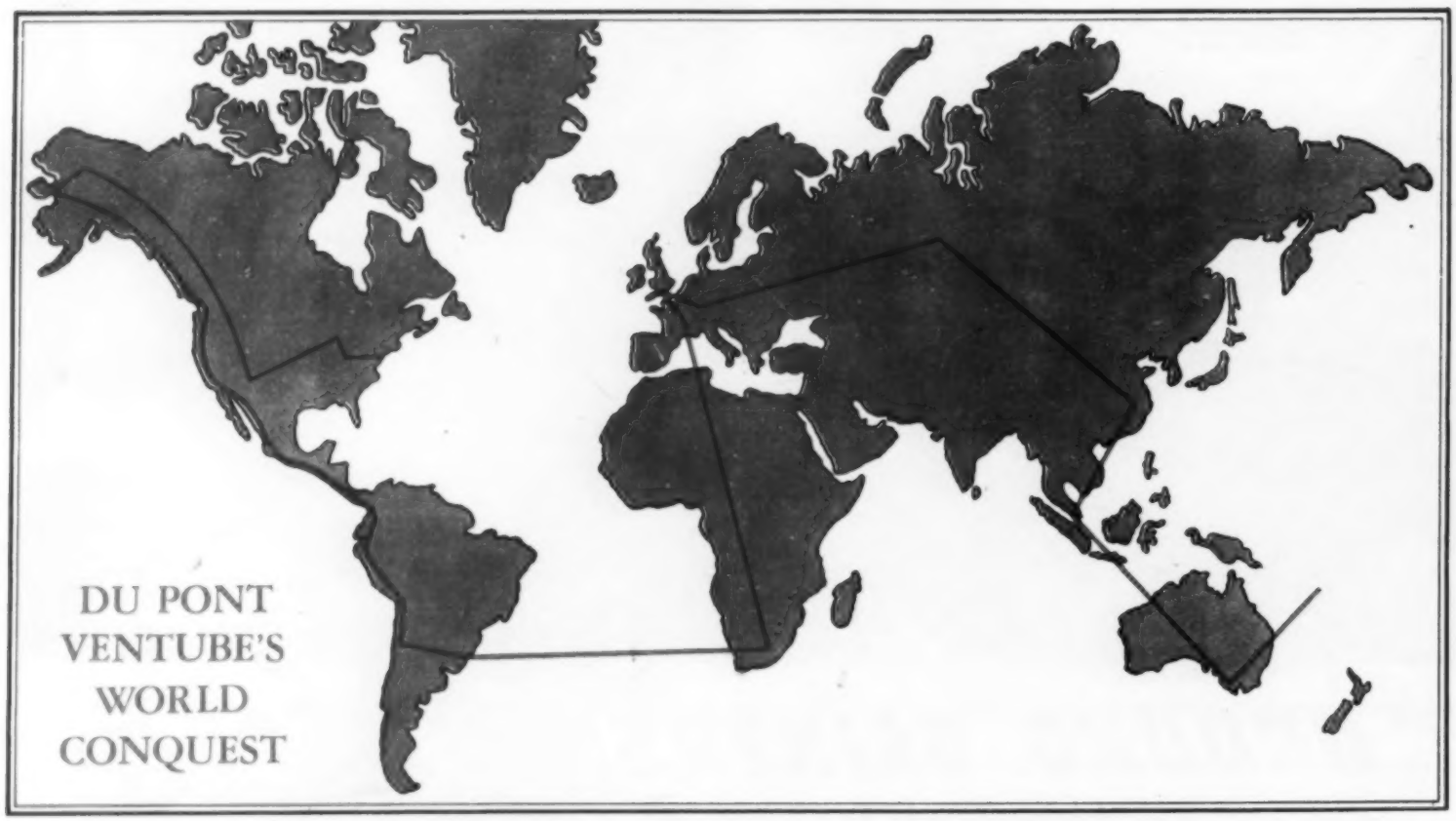


Du Pont "VENTUBE", by right of its excellence as a ventilating duct, has, in the comparatively few years it has been on the market, won its way around the world.

You'll find du Pont "VENTUBE" used by construction and mining engineers in all sections of the United States and Canada, Mexico, Chile, Argentina, France, Russia, the Balkan States, the gold mining sections of Africa, throughout the Far East and Australia.

The reasons for its choice are known to all engineers who have used it:

1. After blasting "VENTUBE" can be quickly brought to the working face, made to dissipate gases quickly, thus increasing the efficiency of the miners.
2. One man can suspend 200 feet in an hour.
3. Delivers air with a minimum loss and friction.
4. Being highly flexible, it goes anywhere.
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*For information on the use of "VENTUBE" in any tunneling project write to—*

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THIS new Cletrac 35 Diesel has stepped right in and gone to work on every type of tractor work. Day after day the 35 Diesel is setting new records for tractor performance. The six cylinder, full Diesel engine, electric starting, controlled differential steering and positive lubrication are typical of the structural advantages of Cletrac Crawler Tractors. Owners everywhere, on big jobs and small, are finding that the new 35 Diesel not only pays its way . . . it shows a profit.

Write The Cleveland Tractor Co., 19300 Euclid Ave., Cleveland, Ohio, for complete information on the new Cletrac 35 Diesel.

35 DIESEL

CLETRAC *Crawler Tractors*

THE *only* CRAWLER TRACTOR WITH CONTROLLED DIFFERENTIAL STEERING

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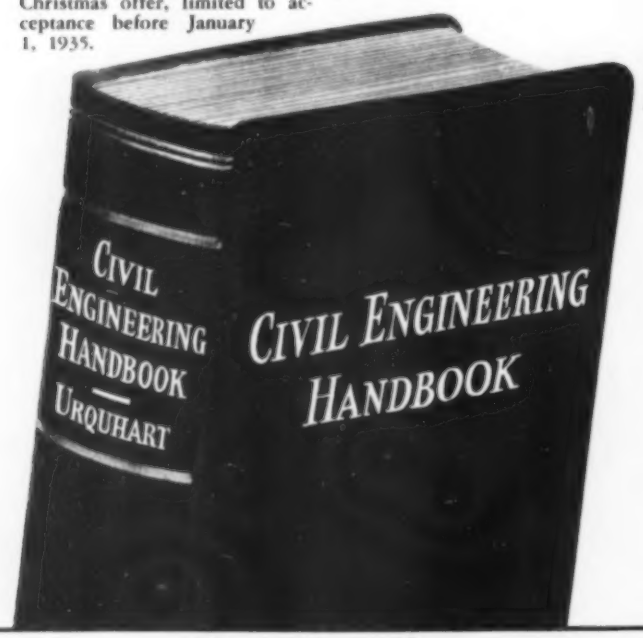


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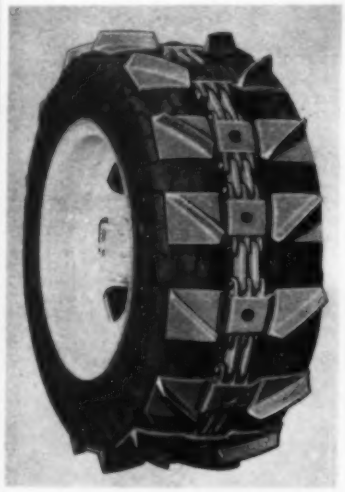

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J & S TRACTION TREADS will put every ounce of Engine Power into your Tractor Wheels in Mud, Sand, or Snow and Ice.

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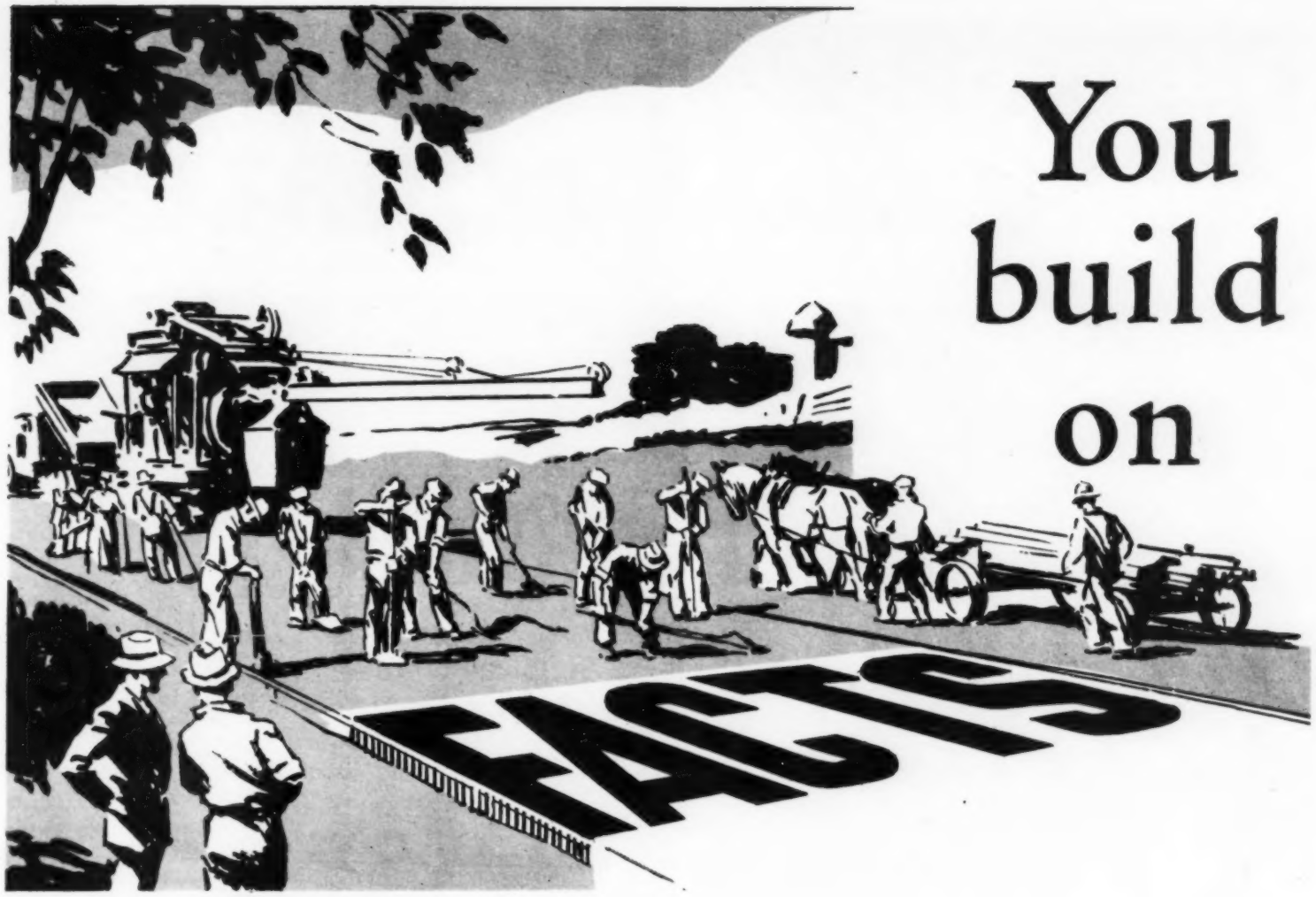


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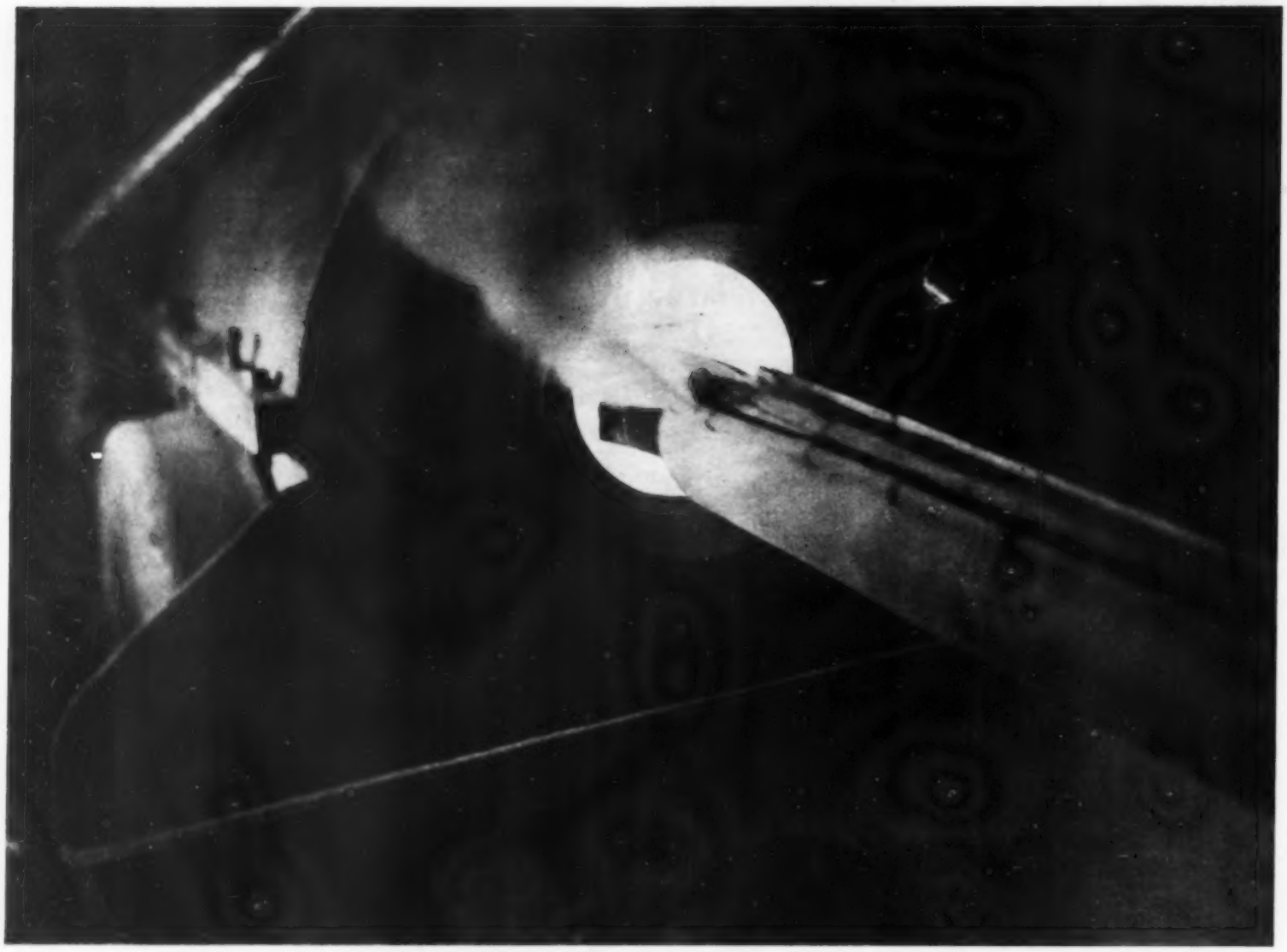

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**CENTRIFUGALLY CAST WITHOUT CHILL IN A METAL MOLD**

Yes! *it can be profitable to hook up jackhammer holes with* Cordeau-

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THE ENSIGN-BICKFORD COMPANY

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*Whittling?*

*No...*

HE'S SHARPENING HIS PENCIL

ERITY DEMANDS *that* BOSS *make money, too*

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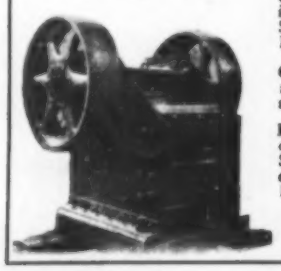

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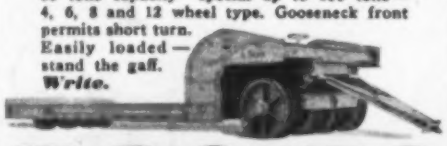

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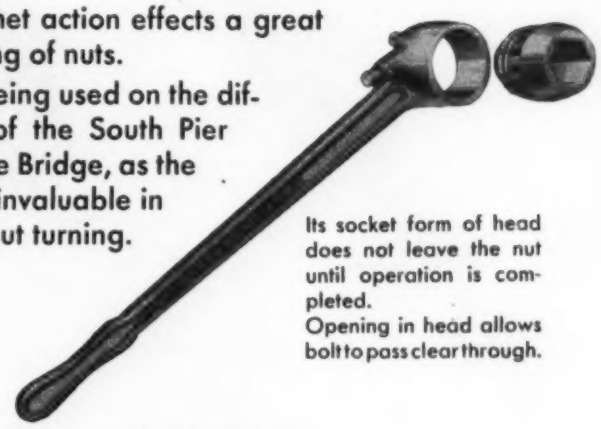

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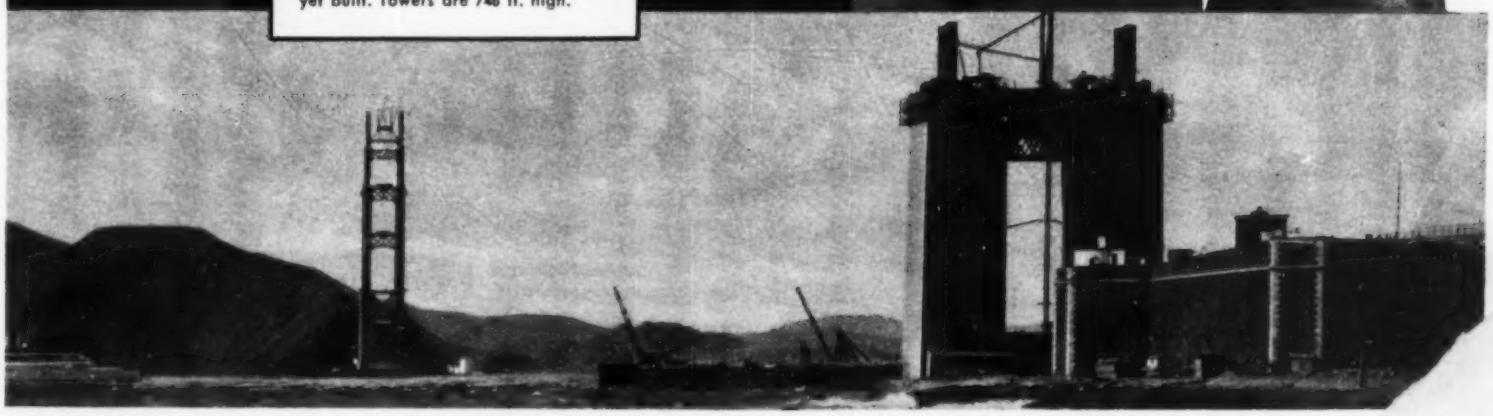

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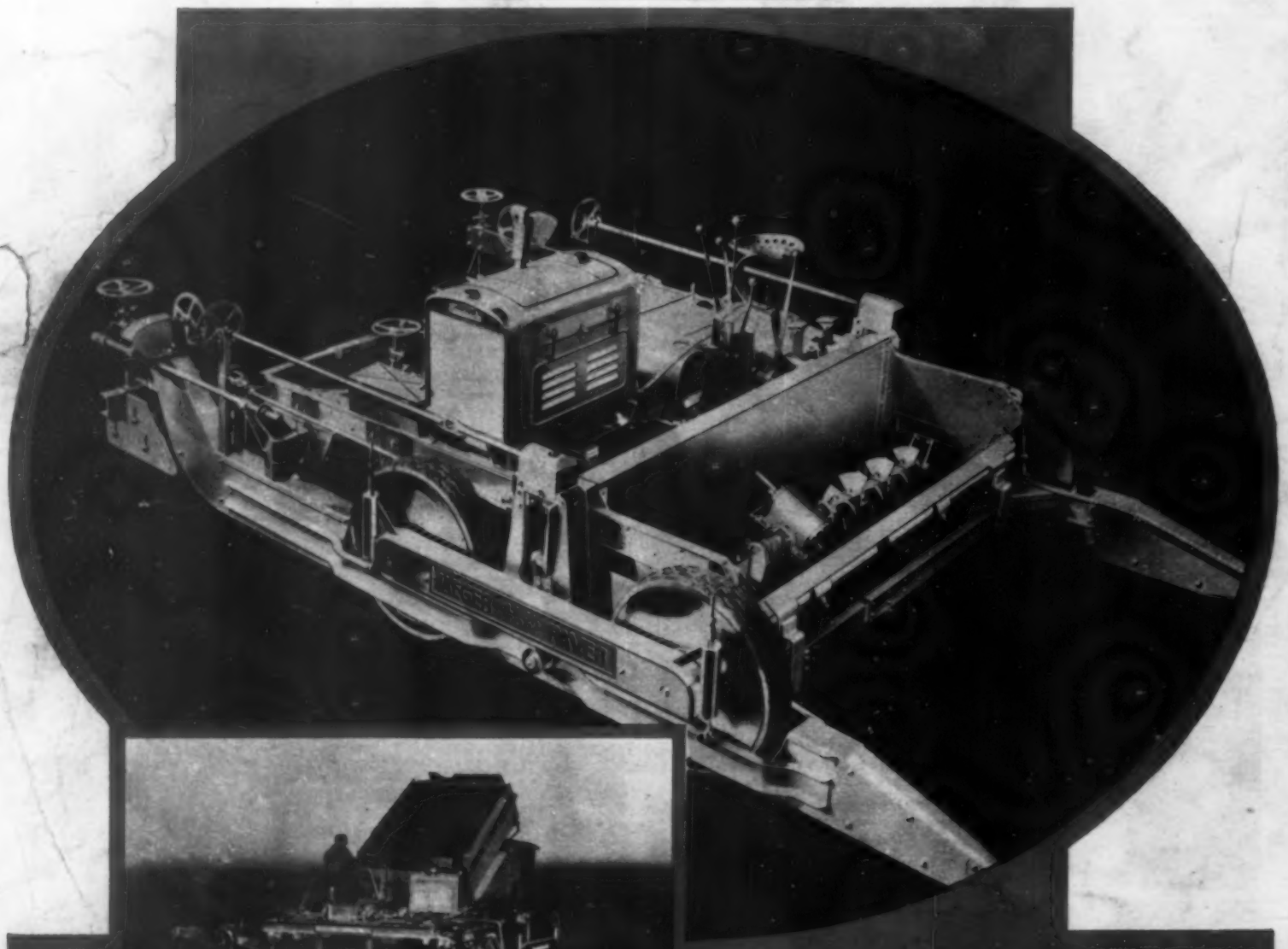

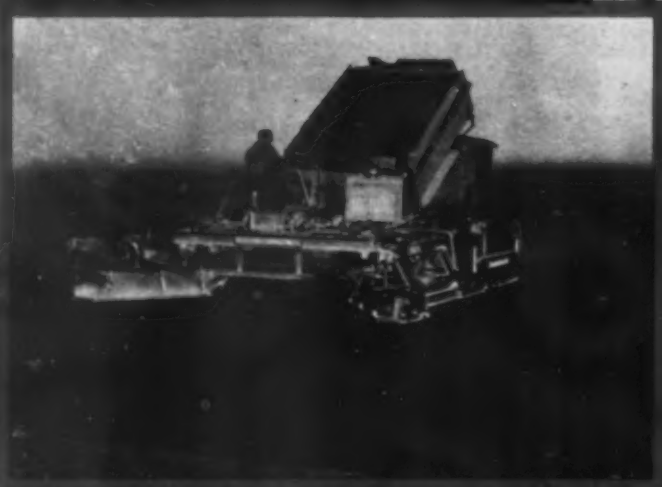

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